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Agriculture.

ONION GROWING.

Although in April, 1919, we published an article on onion growing, we this year again deal with the subject, as many later selectors have taken up land during the year with a view to market gardening and also of producing some crops in a wholesale manner. Amongst such crops are onions, and now is the time for preparing for the crop.

There is no reason why onions should be imported in such quantities as we see daily arriving by steamer from the Southern States. The climate here is perfectly adapted to them, and, if only planted on suitable soil and given the necessary attention, heavy crops are an almost certain result. At one time it used to be said that onions could not be profitably grown as a field crop in the Blenheim district, near Laidley. To disprove this, the writer determined to experiment on the sandy loam of the scrub land on Sandy Creek. The seed was sown in April; the variety, Brown Spanish. The land to which they were to be transplanted was well worked and then rolled to make a hard, compact bed. Transplanting was carried on throughout July, and the season having proved favourable the result was a heavy crop of magnificent bulbs, which gave a splendid return for the labour expended. Now, if such a result can be obtained by one farmer, it follows that others can do the same. As there are thousands of acres of similar land under cultivation both there and in many other portions of the State, it only requires determination on the part of the farmers to enable them to successfully displace the importations from the South.

On looking over an old diary of farm operations, it appears that the writer's crops averaged 6 tons per acre, and sold at £25 per ton. Are there many crops which will give a like return? The present price of onions in the market is about £17 per ton. Now, suppose a crop to yield 8 tons per acre (and we know that double that return has been made), the cash return for a medium crop will amount to £136. Certainly there is a considerable amount of labour involved in planting out an acre or two of onions, but that labour is amply compensated for by the net returns.

A consideration of the following notes, based on practical experience, may, therefore, be of some service. Let us first consider

THE SOIL.

The most suitable soil for onions is a rich sandy loam, such as that of the Blenheim scrubs—free, friable, and easy to work, a soil that will not cake, and not lying so low as to retain the superabundant moisture after heavy rains. In such a case the land should be well drained. An eastern or south-eastern aspect has been proved to be better than if the land sloped to the west, as the onion does not require intense heat to bring it to perfection.

Before sowing the seed, it is important that the seed beds should be clear of weeds and of their fallen seeds. By sowing in April or May, there is not much to fear from weeds; still, it is advisable that the land, both of the seedbeds and of the area proposed to be planted out, should be turned up and exposed to the weather for some time previous to sowing. As soon as the weeds appear, give the land a good scuffling, and if this be done two or three times between March and April there will be no trouble afterwards. If the soil be not virgin scrub, or if it has borne crops for many years in succession without manuring, it should be thoroughly well manured with stable dung, ashes, bonedust, &c., as the onion demands plenty and the best of nourishment. New scrub land is rich enough in natural fertilisers not to require any addition of manure.

PREPARING THE SOIL.

In planting out onions a very serious mistake is often made, and that is, the soil is carefully worked, reduced to a fine tilth, and the plants are set out in a soil which is loosened to a depth of perhaps 8 inches. From land prepared in this manner no good results need be expected. The onion requires a firm bed; otherwise the plant, instead of making a large well-shaped bulb, will run to neck, and have more the appearance of a leek than of an onion. Therefore, the land before being planted must be well solidified by rolling.

THE SEEDBED.

Onions may be sown broadcast, or they may be drilled in, or they may be sown in a seedbed and afterwards planted out in the same manner as cabbages. The best way is to drill them in. In this case, about 2 lb. of seed per acre will be required. The seeds must be dropped at a distance of about 2 inches apart in the drill, and the drills should be from 12 inches to 15 inches distant from each other. The plants will afterwards require thinning out with the hoe. When sown in a seedbed, planting out must be resorted to—a tedious process, but one that pays well for doing well.

On rich soil the plants may be 6 inches apart. The drills should be slightly raised, and the roots of the plant firmly embedded in it—allow the bulb to, as it were, squat on, not under the surface. As the plant grows, the soil must be kept perfectly clear of weeds, and, where the working of the ground has thrown the soil against the bulbs, it must be drawn down, so that only the root is in the ground. Where this has not been attended to, the remedy for the resulting want of bulb formation is to wring the necks of the plants, or, at least, to bend them down with a twist. This will have the effect of inducing the formation of bulbs.

When sowing the seed, care should be taken that they are not covered to more than their own depth. If sown deep, many seeds fail to germinate, and most of those that do appear will make an abnormal growth of neck, causing much labour in drawing away the soil from the incipient bulbs. The writer has never sown onions broadcast, and therefore offers no opinion on the value of the method. Of course more seed would be required per acre, and, if weeds are troublesome, a good deal of hand work would be necessary.

Now, about the seed. There are few seeds so annoyingly deceptive as onion seed. So difficult was it to get good seed in the State even at 10s. per lb. in the good old days, that growers imported it from Spain. The largest growers at Oxley, Messrs. Martindale and Nosworthy, were most successful with imported seed, but the writer had a very bad experience in this business. Twenty pounds weight of onion seed was sent from a friend in Germany. Instead of packing it in hermetically sealed bottles, he stowed it in calico bags in the body of an immense wooden Swiss cuckoo clock. When the clock was opened the bags of seed were examined, and looked perfect in colour and shape; but, alas! when subjected to pressure, no oily fatness was perceived; and when at last it was given a chance and sown thickly in drills, five acres returned the magnificent yield of 72 lb., which, at the rate of £28 per ton, amounted to 18s. Certainly, the land, after a week's waiting for the seed to germinate, was utilised otherwise, but not 1 cwt. of onions was harvested.

Make sure, therefore, of the seed. After sowing, it should germinate in less than a week.

In former days large onions were always aimed at, but now the public taste is in favour of medium-sized bulbs, so that closer planting may be adopted.

Onions may be known to be ripe by the drying up of the tops. As soon as this happens, take them up by hand and leave them on the ground between the rows to dry. As soon as they are dry, carry them carefully with as little bruising as possible to the barn.

As before stated, the Brown Spanish has proved most successful in this State, but the gentlemen above mentioned grew what they called the large White Portugal onion. It certainly was a splendid bulb, and fetched very high prices in the markets of Brisbane, Maryborough, and Rockhampton.

COST OF WHEAT PRODUCTION IN NEW ZEALAND.

The theory that wheatgrowing in New Zealand at the Government average price of 6s. 8d. a bushel is not a profitable proposition is demonstrated by an analysis of the cost of production, says the agricultural editor of the Christchurch "Weekly Press." He submits figures to prove this. They relate to 1 acre, and are based on fair contract prices for such work, which may be taken to cover interest, depreciation, and repairs on implements. It may be assumed that wheatgrowing land in Canterbury, capable of growing 27 bushels to the acre, which is the Canterbury average over a number of years, is worth £30 an acre. The cost of ploughing is set down at an average between lea land and stubble, and on these bases the cost can be claimed to work out as follows:—

	£	s.	d.
Interest on £30 at 6 per cent	1	16	0
Ploughing	0	12	6
Seed (1 2-3 bushels at 6s. 10d.)	0	11	5
Manure (1 cwt.)	0	9	0
Threshing (27 bushels at 1s.)	1	7	0
Cultivating (two strokes) 7s., harrowing (two strokes) 2s. 6d., drilling 3s., pickling seed 6d., harrowing after drilling 1s. 3d., rolling 3s., reaping 7s., twine (5 lb. at 8d.) 3s. 4d., stooking 2s. 3d., other labour 5s., loss on sacks 2s., seaming twine 4d., carting to railway 7s.	2	4	2
	£7	0	1
Value of crop (27 bushels at 6s. 8d.)	9	0	0
Profit on 1 acre	£1	19	11

The farmer that sows 50 acres of wheat has something less than £100 out of which to pay rates, taxation, keep his fences and ditches in repair, and generally provide for the evening of life. In addition, a value has to be attached to the severance of a farm, unproductive portions occupied by buildings, and occasional roadways and quite a number of small out-goings known to the tiller of the soil. Then the exhausting character of the crop has to be considered, and its dependability on seasons. But, above all, the payability of wheat production does not compare with other branches of farm activity. How would dairymen, who can run a cow to the acre, and return from £20 to £25 annually, like to accept £1 19s. 11d.?

BREEDERS OF PUREBRED STOCK.

Name of Owner.	Address.	Number of Males.	Number of Females.	Herd Book.
		AYRSHIRES.		
W. C. Smith	"The Haven," Goomeri	1	7	Ayrshire Society of Queensland.

Poultry.

REPORT ON EGG-LAYING COMPETITION, QUEENSLAND AGRICULTURAL COLLEGE, FEBRUARY, 1920.

Another very unfavourable month for egg production has been experienced. For days at a time the thermometer has registered in the proximity of 100 degrees. No rain fell during the month, but greenstuff has been procurable. R. Burns's D. bird laid 26 eggs for the month, bringing her total to 307 eggs. The 300th egg was laid on the 21st of the month. R. Holmes's E. bird laid 24 for the month, making her total 298. A Kelving Poultry Farm's Plymouth Rock laid 22 for the month, her total for the eleven months being 278. A Chinese Langshan, owned by J. Ferguson, has laid 250 eggs for the eleven months. The leading Leghorn has laid 272, and is owned by B. Caswell. Two deaths occurred during February, the cause in both cases being ovarian troubles. The following are the individual records:—

Competitors.	Breed.	Feb.	Total.
	LIGHT BREEDS.		
*T. Fanning	White Leghorns ...	124	1 489
*J. M. Manson	Do.	117	1.476
*E. A. Smith	Do.	118	1,408
*W. Hindes	Do.	95	1,373
*Dr. E. C. Jennings	Do.	90	1,320
*G. W. Hindes	Do.	106	1,294
*W. Becker	Do.	115	1,281
*Dixie Egg Plant	Do.	69	1,266
*Range Poultry Farm	Do.	90	1,262
*Haden Poultry Farm	Do.	96	1.259
*Quinn's Post Poultry Farm	Do.	88	1,254
*B. Caswell	Do.	87	1,248
*C. P. Buchanan	Do.	81	1,215
*H. Fraser	Do. ...	92	1,212
J. H. Jones (Toowoomba)	Do. ...	72	1,199
S. McPherson	Do.	82	1,191
*L. G. Innes	Do.	74	1,180
W. A. Wilson	Do.	93	1,176
*W. Lyell	Do.	90	1,171
*Mrs. L. F. Anderson	Do.	86	1,162
*J. J. Davies	Do.	84	1,157
*Mrs. A. G. Kurth	Do.	85	1,150
*Thos. Taylor	Do.	107	1,150
S. W. Rooney	Do.	107	1,128
Geo. J. Byrnes	Do.	91	1,128
G. Williams	Do.	52	1,096
Mrs. N. Charteris...	Do.	100	1,088
*Mrs. R. Hunter	Do.	71	1.066
Geo. Trapp	Do.	78	1,063
H. A. Jones (Orallo)	Do.	62	1,043
*O. W. J. Whitman	Do.	73	1,041
N. A. Singer	Do.	104	1,039
C. A. Goos	Do.	75	1,021
B. Chester	Do.	66	1,016
H. O. Jones (Blackstone)	Do.	89	1,002
Oakleigh Poultry Farm	Do.	81	995
G. H. Kettle	Do.	56	989
J. W. Newton	Do.	59	972
R. C. J. Turner	Do.	72	949
J. H. Dunbar	Anconas	74	899
W. Morrissey	White Leghorns ...	71	887

EGG-LAYING COMPETITION—*continued.*

Competitors.	Breed.	Feb.	Total.
	HEAVY BREEDS.		
*R. Holmes	Black Orpingtons ...	114	1,492
*E. F. Dennis	Do.	119	1,448
*R. Burns	Do.	103	1,418
*E. M. Larsen	Do.	83	1,337
*A. E. Walters	Do.	100	1,302
*W. Smith	Do.	67	1,297
*E. Morris	Do.	102	1.237
*Kelvin Poultry Farm	Plymouth Rocks ...	91	1,214
Geo. Nutt	Black Orpingtons ...	75	1.202
*Mars Poultry Farm	Do.	106	1,184
*T. Hindley	Do.	86	1.176
*Nobby Poultry Farm	Do.	69	1,164
R. B. Sparrow	Do. ...	104	1.148
*A. Shanks	Do.	62	1,140
*Jas. Ferguson	Chinese Langshans ...	95	1,133
*D. Fulton	Black Orpingtons .	81	1,086
*W. H. Reilly	Chinese Langshans ...	87	1,061
A. Homan	Black Orpingtons ..	89	1,060
Burleigh Pens	Do.	82	1,057
*F. W. Leney	Do.	66	1,003
J. A. Cornwell	Do.	86	999
C. H. Singer	Do.	75	955
*H. Puff	Rhode Island Reds ...	61	953
H. Ashworth	Black Orpingtons ...	74	919
A. Gaydon	Do.	75	911
*T. B. Barber	Do.	71	905
Total	...	5.756	77,116

* indicates that the pen engaged in single hen competition.

RESULTS OF SINGLE HEN PENS.

Competitors.	A.	B	C.	D.	E.	F.	Total.
	LIGHT BREEDS.						
T. Fanning	246	232	244	263	245	259	1,489
J. M. Manson	253	232	261	256	222	252	1,476
E. A. Smith	235	227	250	232	220	244	1,408
W. Hindes	240	240	237	207	217	232	1,373
Dr. E. C. Jennings	227	202	217	213	205	256	1,320
G. W. Hindes	225	220	235	210	195	199	1,294
W. Becker	245	224	234	205	174	199	1,281
Dixie Egg Plant	193	214	225	202	206	226	1,266
Range Poultry Farm	199	219	229	224	188	203	1,262
Haden Poultry Farm	238	225	215	204	165	212	1,259
Quinn's Post Poultry Farm ..	199	202	211	249	193	200	1,254
B. Caswell	174	158	201	237	272	206	1,248
C. P. Buchanan	173	237	175	204	202	224	1,215
H. Fraser	163	231	235	210	152	221	1,212
L. G. Innes	149	231	165	210	229	196	1,180
W. Lyell	185	214	220	184	192	176	1,171
Mrs. L. F. Anderson	216	224	185	201	156	180	1,162
J. J. Davies	195	203	203	177	184	195	1,157
Mrs. A. G. Kurth	237	207	205	187	152	162	1,150
Thos. Taylor	197	157	179	217	223	177	1,150
Mrs. R. Hunter	178	121	201	173	194	199	1,066
O. W. J. Whitman	168	206	153	154	187	173	1.041

GRIT, SHELL, AND BONE FOR MUSCOVY DUCKS.

By R. T. G. CAREY (Muscovy Breeder), Beerwah.

All classes of fowls masticate their food by a grinding process in the gizzard. The gizzard is lined with a tough membrane, or rubber-like callous skin, of a corrugated shape; one portion is even harder than the thinner parts, in consequence of the pressure caused by the process of milling, although the gizzard is immune to injury by hard, flinty, or any other sharp material which may be eaten by the bird. The harder and more insoluble that material, the longer is grinding prolonged. Hence, bits or pieces of broken delf, glass, sharp flint, or granite grit will not cause any harmful effects, but are all suitable ingredients, and should be kept before the ducks continually. In fact, it is indispensable for birds of all ages, figuratively speaking, from egg to egg. There is no fear of their eating too much grit, their judgment in that respect being carefully gauged. You have by glancing into the grit vessels which would show depletion a guide to the amount required, and how often fresh supplies are needed.

Muscovy Ducks require a smaller size, even finer, than for poultry. I do not intend to discuss the precise mechanical office of grit; nevertheless, if ducks were to consume grit for the sake of supplying millstones or grinding pebbles, they would soon overdo it, but when the usefulness of grit becomes exhausted it is cast out for sharper and more cutting ones. As an examination of a gizzard reveals, many have become quite round or oval from continuous slow movement, while in that organ the average healthy Muscovy duck deposits enough grit in a week to last it for a year for all purposes if it were not for its wearing. The grit is ground down to round particles by the continual motion, muscular contraction, and dilation of the gizzard, combined with the cutting of fibrous and fleshy materials to a pulp, and moistened by the juices of the herbs and any other factor that may contribute to the pulverising of their foods. Hence the essential requisition of grit as part and parcel of the Muscovy's *ménu.*

Shell, an organic and calcareous substance composed chiefly of lime, is also an essential and a necessity, and must be supplied in some form, chiefly by oyster, mussel, and other sea-shells, lime-rock, from some insects, even old mortar, or old plaster. With such a superabundance of lime-supplying material for our disposal and use, it ought never to be inadequately supplied or withheld from Muscovy ducks. Yet how neglectful and forgetful are owners of those beautiful, massive, webbed-footed fowls in withholding shell grit, that much-needed article. "*It is the secret of success.*" Lime, no matter by what channel it is administered (as slack or kiln lime, for example), is to the young ducklings as mortar is to the bricklayer. What sort of a house could a mason build from rubble-stone without mortar (water, lime, and sand) to hold the bricks or stones together, and also to withstand the elements and tempest? Similarly with the rearing of young Muscovy ducklings. Why, you cannot get those great frames built which form the birds' structure, which are filled up with delicious flesh, if those essentials in forming the bony construction are withheld. The failure to supply those essentials acts detrimentally on the industry, in that your ducks are lacking in size, and soft-shell eggs or shelless eggs result.

Lime is not, in a sense, to be termed a duck food, as it does not in any way sustain life, but for egg-production it plays an important part and for the help it gives in bone-forming. Animals' bones ground to small particles aid and contribute a very valuable asset to the rearing of the young Muscovy ducklings; however, do not feed it too heavily. It is usually mixed into and given with the morning mash. In fact, it is best to reduce the bone and the shell grits to a powdery state, and give the ducks portion of it every alternate day.

In conclusion, let me remind you that no single formula can be used for best results during the entire year, as the proportions harmonise with the seasons, like the laying season. The consumption of lime is greater than during the moulting season. It will also be seen that, in rearing ducklings, the consumption is greater than in the case of the adult. Therefore, be guided and governed by observation of your empty grit, shell, and bone boxes.

BOT-FLY REMEDY.

According to Professor Cook, Stockholm tar, if placed on the nose and inside the nostrils, will prevent the bot-fly from depositing her eggs or larvæ in the nose of the sheep. Place Stockholm tar in the bottom of a trough to the depth of 1 inch, and cover with salt. In this way the tar gets on the nose and into the nostrils while the sheep is gathering the salt.

Dairying.

MAKING BUTTER FOR CONSUMPTION WITHIN THE HOME.

In the parts of this State where dairying is in general practice, it has become the custom to forward the cream raised on the farm to a butter factory, where the cream is received, treated, and manufactured into butter. To those supplying cream in this way to the factory, the process of manufacture of small quantities of butter on the farm is generally well understood. However, there is a number of persons scattered throughout the State who milk one or more cows, and have neither the desire nor the opportunity to tender the cream from the milk to a butter factory, but on the other hand, they are anxious to make butter from the cream. Frequently, advice upon the procedure to be followed in so doing is sought from this office, and it is with the object of meeting inquiries of this nature that the subsequent simple particulars are supplied relative to the production of milk and cream, and the manufacture of the latter product into butter. The more important matters for observation will be referred to in their natural sequence.

Primarily it must be understood that the flavour of butter is influenced by—(*a*) the class of food to which the cows have access, (*b*) the degree of cleanliness practised in the handling of the milk and cream, and the skill exercised in the manufacture of the butter.

Many varieties of weeds and some useful fodders are capable of conveying objectionable flavours or taints to milk, and, in turn, the tainted flavour is noticeable in the cream, and ultimately the flavour of the butter is affected.

The tainting influence of fodders is minimised by feeding same to cows directly after milking, but not immediately preceding same.

Thorough cleanliness is necessary to prevent contamination of the milk or cream. The cow-bail and place where the cow is milked must have an impervious floor, and be kept in a clean and sweet condition. The udder, teats, and flanks of the cow should be washed and wiped prior to milking. The hands of the person who intends to carry out the milking should be cleansed similarly.

The milk should never be exposed to an impure atmosphere.

Strain the milk without delay after it is drawn from the cow by running it through a very fine-mesh gauze or, preferably, through a strainer fitted with a wad of sterilised cotton.

The milk should next be passed through a separator, or set in dishes to allow it to cream, the separator proving by far the more satisfactory means of obtaining the cream. If setting of the milk in dishes has to be restorted to, it will be found that shallow dishes, which provide a comparatively large surface for the cream to gather upon, are more satisfactory than deeper vessels with a limited surface.

Generally the milk is allowed to sour, or even coagulate before the cream is skimmed off, but no more cream can possibly rise to the surface after the milk has thickened. The layer of cream is removed with the aid of a utensil termed a "skimmer," the customary makeshift being a tablespoon. The objective should be to collect as much cream as possible, but to avoid gathering any of the milk with it.

The cream is best placed in an enamel vessel and should be kept as cool as possible. It must not be brought into contact with a tainted atmosphere, for the cream readily absorbs odours from such a source.

It is advisable not to mix the cream obtained by individual skimmings, or separations of the milk, until some hours before churning time, when the whole of the cream available for churning should be placed in one receptacle, and allowed to ripen uniformly. Always avoid the mixing together of hot and cool cream.

A certain amount of lactic acid should be permitted to develop on the cream before churning, and this usually requires from thirty-six to forty-eight hours, according to the care taken and the temperature at which the milk and cream are held. Holding either milk or cream at comparatively high temperatures expedites the development of the acidity.

Generally natural temperatures in Queensland, particularly during the warmer season of the year, are too high to give satisfactory results in the churning of cream, and to remedy this difficulty, artificial cooling of the cream by the aid of an ice-chest is advantageous. The water used for butter-washing purposes may be placed in a vessel and similarly cooled in the ice-chest. A more primitive means of cooling the cream is to stand the vessel containing it in water drawn from an underground well or spring; another method is to make a canvas jacket to cover the vessel holding the cream, and to arrange that the edges of the canvas covering reach a supply of water, which is drawn up by capillary attraction, and acts on the same principle as the cooling of water in a water-bag.

Usually good results in churning are obtainable by having the cream at a temperature of 56 degrees to 58 degrees Fahr. during the cooler months of the year, and reducing the temperature of the cream preparatory to churning several degrees lower throughout the warmer season.

In butter-making there are certain requisites and appliances that must be provided, even in cases where primitive methods are practised. Firstly, an ample supply of both hot and cold water must be available. The cold water is necessary for the purpose of washing the butter, and the hot water is required for use in cleansing and scalding the dairy utensils.

The water may be drawn from either a tank or well supply, provided it is wholesome. What is known as "hard" water from a well supply may be employed for washing the butter, so long as this condition of the water is caused by the presence of salt or limited percentages of other mineral matter, not injurious to health. Water containing decayed vegetable matter should not be used for washing butter.

To recover the cream from the milk, either milk setting-pans or a separator is required. The setting of milk in pans to allow the cream to rise is not to be viewed as a satisfactory or economical method of recovering cream from milk. In the first place, there is the risk that the surface of the milk will catch a deal of fine dust particles from the atmosphere while awaiting for the cream to rise; another disadvantage is, that a large percentage of the butter-fat content of the milk is not recoverable by this method. A small-sized separator provides by far the more advantageous means of recovering the butter-fat from milk. Separators of a wide range in skimming capacity are procurable, and one should be secured of a capacity in agreement with the complement of milk to be treated.

A churn is necessary. There are many types of churns that have been designed to meet the requirements of those who desire to churn, for their own use, small quantities of cream. Generally, all are capable of churning satisfactorily. For convenience, the churn should be simple in construction, durable, and so designed as to be readily cleansed.

Two butter pats for use in working and salting the butter should be provided.

Hand power butter-workers are procurable on the market, but such appliances (while admittedly most serviceable) are more suited to cases wherein the operations of the butter-maker are carried on in a comparatively large scale. In instances where it is intended to manufacture sufficient butter to satisfy the requirements of a family, the two pats are to be made to perform successfully the working and patting of the butter. This process can be carried out in a clean shallow dish if so desired.

A dairy thermometer is a most useful article, and should be included in the equipment of the dairy; and by its aid the temperatures of cream or water may be determined from time to time.

Churning is simply a mechanical process for bringing together the butter-fat globules in the cream in order to make them coalesce or unite. Preparatory to the churning of cream, the utensils used in connection with the process should be dipped in scalding water and then rinsed in clean cold water.

The whole of the cream from the various skimmings or separations of the milk (that should have been cooled and mixed in a container for some hours prior to churning time) is placed in the churn and the churn is put into operation.

If the churn is of a design that allows the operator to view the cream while churning, it will be noticed that, after some little time under the churning process, the cream will assume a paste-like consistency and possess a smooth texture. At a later stage the cream will appear to increase in density, and subsequently the texture will appear gritty. This gritty appearance of the texture of the cream is occasioned by the unison of the fat globules, and indicates that the churning is nearing completion. Care should be taken at this stage that no cream is allowed to remain stationary on the sides of the churn, and any cream attached

thereto should be removed and brought under the influence of the "paddles" of the churn with the main bulk of the cream. Otherwise a portion of the cream will remain unchurned, and be carried away and lost with the butter-milk.

As soon as the cream "breaks," it is advisable to add a small quantity of cold water to flush the sides and paddles of the churn, using about half a pint of water to each quart of cream in the churn. Carry on with the churning process until the globules gather in particles about the size of a grain of wheat. Now stop the churning and allow the butter to float upon the butter-milk, which should then be drawn off. In the case where the temperature of the cream is higher than it should be for correct churning, the butter-fat fails to assume a granular appearance, but gathers rather in the form of a mass of soft fat. However, this does not call for any change in the procedure in so far as the draining off of the butter-milk is concerned. When this is done, add wash water to the churn, and wash the butter, working the butter with the pats in order to eliminate the butter-milk as thoroughly as posssible. The temperature of the wash water should be several degrees below that specified for the cream. It is well to remember that the incorporation of an excessive amount of butter-milk in the butter will result in the keeping properties of the latter being prejudicially affected.

In some cases a second washing of the butter is advantageous, but this is dependent upon the degree of success attained in removing the butter-milk in the first washing. After the washing of the butter has been effected, add fine salt to the butter in the proportion of half an ounce of salt to each pound of butter.

Work the butter steadily with the pats, taking care not to injure the grain of the butter more than is necessary in expelling the excess of moisture. The working also mixes and incorporates the added salt with the butter.

If the churning of the cream has been carried out efficiently and correct temperatures observed and the butter properly washed, the moisture showing in beads on the finished article will be in the form of a crystal clear brine.

The butter is now ready for use, but as it is capable of absorbing odours given off by other strong flavoured foodstuffs, it should be stored away beyond attack from such influences in clean surroundings and kept as cool as possible.

THE EFFECT OF SOILING ON BREED: HOW IT PREVENTS REVERSION TO TYPE.

The advantages to the dairy farmer of the soiling system—that under which a succession of fodder crops is grown and carted out to the animals in the field or barn—are many and substantial. The following paragraphs are from the pen of a recent writer on the subject:—

"The influence of soiling on breed is enormous. After all, it is the soiling system—carried on through the greater portion of each year during the centuries—that has built up the great breeds. Take, for instance, the most famous of all the butter breeds—the Jerseys and Guernseys. The soiling system has made them what they are, and maintains them at their present high pitch of excellence. For centuries

the Channel Island farmers have soiled their cows. The land is far too expensive to farm in any other way. As in the Channel Islands, so also on the English and Danish stud farms. Where the great milking breeds have been built up, soiling has been and is carried on to an enormous extent. The breeds could never have been built up without it.

"It must be remembered that the dairy cow as we know her to-day is not one of nature's productions, but one of man's. Nature's only concern is that a cow should produce enough milk to nourish one or two calves. If man wants anything better than this he must develop it himself. Man has wanted more, and has developed more by careful judging and selection. But the moment that careful selection and regular full feeding cease, a steady but certain reversion to type begins to take place. The animal in herself and her descendants slowly go back to a state of nature. The high development of the milking function can only be kept in that condition by persistent effort.

"FEED THE GREAT FORCE.

"On every poor grazing farm throughout New Zealand this down-grade process of reversion to type is going on to a greater or less extent. A farmer pays out a stiff sum of money for some really good stock, and full of hope brings them on to his farm. Just at first the results justify expectations; but as years go by the farmer is sadly disappointed. He selects carefully year by year, yet still the results are not what he had hoped for. Now, why is it? It is simply that the great force that built up those good cows is being slackened. Feed was the great force, and the cows now don't get, either in quantity or quality, what their forbears got. They have to roam over large areas of indifferent pastures for a living. They are being compelled to live very much according to the conditions under which their very remote forbears lived, as wild cattle. The farmer has done his best to select, and this is a tremendous aid to the great force of feeding. But he may select until he is black in the face; he will not stop the down-grade movement in his herd if he neglects the primary factor in the development and maintenance of breed—full feeding.

"BREEDING GONE TO WASTE.

"In New Zealand there has been an enormous amount of money wasted owing to this reversion to type. Thousands of pounds have been spent in importing pure-bred stock from other countries. They have been turned out to forage for a living like a common cow, and have consequently run steadily down. This sort of thing is going on to a greater extent now than fifteen years ago, simply because many of the dairying lands are not as good now as they were then. You can't go on dragging out of the soil the valuable constituents that milk is composed of, year after year, and sending them away in the form of butter and cheese and bacon, without weakening it enormously and making it less and less capable of supporting cow life profitably.

"As a matter of fact, a pure-bred cow will not do as well as a mongrel very often, if she is placed under the conditions (as she generally is) to which the mongrel is accustomed. But a pure-bred cow under the soiling system will give better results (all things being equal) than the mongrel, because the pure-bred is then being kept under the conditions which she and her progenitors were accustomed to."—"Farmer and Grazier."

A CLEAN MILK SUPPLY.

By R. B. TENNENT (N.D.D.)

The rapid advance in the study of bacteriology during recent years has served to demonstrate more than ever the danger of supplying unclean milk to the general public. The problem of providing an adequate quantity of good pure milk at a reasonable price has for many years occupied the attention of our Public Health authorities, who fully recognise its vital importance from a public health point of view, but, unfortunately, their efforts have not so far proved successful in securing for the consumer milk certified free from harmful bacterial contamination.

In Australia we have laws ensuring that the "quality" of milk shall be of a certain standard, prohibiting adulteration either by the addition of water or removal of butter-fat, and one has only to note the frequent prosecutions of unscrupulous vendors to realise that such laws are necessary and efficacious. Although important, this aspect of the question will not be dealt with here, attention being directed to the even more important subject of supplying a really clean and wholesome milk for general consumption.

In view of the fact that we hear so much concerning the national necessity for preserving infant life, and that various "Child Welfare Centres" have been established to attain that laudable object, this is an opportune time for a general review of the whole question, and a consideration of the more important results arrived at by recent investigators. Obviously, it is impossible, in an article of this length, to deal fully with the various problems pertaining to the subject, stress being chiefly laid on its serious nature and the urgent necessity of obtaining proper and efficient control of the country's milk supply.

MILK-BORNE DISEASES.

At the present time, a great deal of loose talk is heard about the dangers of milk, and although often exaggerated and emanating from the ill-informed, such talk contains a certain amount of truth. There can be no question that milk, so widely consumed and so readily contaminated, may be a vehicle for the transmission of infectious diseases to man. The infectious diseases which have been shown to have been spread by milk are as follows:—

Diphtheria.	Typhoid fever.
Scarlet fever.	Infective sore throats.
Malta fever.	Gastro-enteritis.
Dysentery.	Cholera.

That tuberculosis may be conveyed to human beings by the consumption of milk has more recently been proved, and the chief sources of infection can be conveniently grouped under three headings.

A. Direct human infection.
B. Indirect human infection.
C. Bovine infection.

DIRECT HUMAN INFECTION.

Where a person who comes into direct contact with the milk is suffering from some form of disease, whether acute or latent, the possibilities are that some of the germs of that disease will enter the milk. In the case of "carriers," *i.e.*, persons not actively suffering from the disease, yet carrying the germs of it, it will be a difficult matter to ascertain the source of infection.

INDIRECT HUMAN INFECTION.

The infection may originate from water polluted by the excreta of human beings. Utensils washed with such water would prove a source of contamination.

BOVINE INFECTION.

Contamination may originate in this instance from an animal which is suffering from a disease such as tuberculosis.

The first source of infection is largely responsible for the outbreak of many epidemics, yet, from the dairy farmers' point of view, the third source—bovine infection—is probably of more interest. It is hardly necessary to deal with all the diseases to which the cow is heir and which may be transmitted to man, for excluding tuberculosis, it is generally admitted that the great majority of bovine teat and udder lesions are not a source of danger to man. To the reader seeking a careful review on this subject Savage's "Milk and the Public Health," is confidently recommended; also an important report on "Milk and its Hygienic Relations" (Lane-Claypon, 1916), published under the direction of the Medical Research Committee.

Tuberculosis is by far the most important disease of cows, chiefly on account of its wide prevalence, the frequency with which the bacilli of the disease gain access to milk, and because the disease can, in this way, be transmitted to man through the milk.

It has been proved beyond question that milk may contain the bovine tubercle bacilli, and this being so, it is at once evident that children fed largely on a milk diet are more likely to become infected than the much less susceptible adult, whose powers of resistance are naturally stronger. The presence of the tubercle bacilli in the milk is most commonly due to the udder or teats containing tubercle lesions, but many cases of milk being infected with these organisms have been recorded where no apparent tubercle lesions could be found, either on the teats or the udder. In such cases the cause of infection would, in all probability, be from some other source, such as contamination from manure, &c.

On account of the widespread prevalence of tuberculosis among cattle in Australia, we are faced with a serious problem in attempting to effectively control this disease. Many schemes have been suggested and discarded, such as the compulsory inoculation of every animal, the segregation of the affected, and so forth, but, so far no finality on this point has been attained; therefore it is obvious that until this problem has been successfully dealt with, it will be practically impossible to obtain milk free from the suspicion of infection. One tuberculosis cow in a herd will infect the whole milk supply if she secretes milk containing the tubercle bacilli.

A few facts and figures on this point will prove of interest. The extent to which tuberculosis is prevalent in cows can only be estimated by the use of the tuberculin test. Hunting examined 4,000 English cattle and found 20 per cent. tuberculous. In Massachusetts, U.S.A., during 1897, 58.5 per cent. of the cases reacted; in Saxony, 35 per cent. were tuberculous; in Norway, 8.4; in Belgium, 60; in Sweden, 42; and Denmark, 31. It is noted that the older the animal the higher the percentage. Thus, of 14,684 cows over four years, slaughtered in Berlin 14,556, or 99 per cent., were tuberculous. The lesions, of course, were in some cases trifling, but as the examination was a macroscopic one, the application of the tuberculin test would probably have produced even higher results.

The Medical Officer of Health of the London County Council, during the period from 1907 to December 1913, examined for the presence of tubercle bacilli 13,321 samples of milk forwarded from places outside the county. Of these, 1,323 samples, or 9.9 per cent., were found to contain tubercle bacilli, as shown by the inoculation of guinea pigs. During the year 1913, 9.3 per cent. of the samples examined were found to contain the tubercle bacilli.

In Edinburgh, Mitchell examined 406 samples between November, 1913, and May, 1914, all taken from shops selling milk, with the result that 82, or 20 per cent., were found to be capable of producing tuberculosis when inoculated into guinea pigs.

Delépine examined 7,681 samples of milk from Manchester between the years 1897 and 1913, and found that 8.7 per cent. contained tubercle bacilli. In consequence, 276 farms were inspected, and in 190 of them the veterinary surgeon, *with the help of the bacteriologist*, was able to discover one or more cows with tuberculous udders. After the removal of these cows, the milk generally ceased to produce tuberculosis in guinea pigs. At the remaining farms (about 31 per cent) the source of infection could not be found. From the inquiries made at these 86 farms, Delépine found that in at least 32 cases, cows had been sold between the time of collecting the sample and examining the cows; in others, the farmer had been buying milk from outside sources. From his inquiries he believes that in most of these cases the source of the tubercle bacilli was from a cow not on the farm, and gives as his estimate the following:—

Tuberculous udders the cause of infection	78.6 per cent.
Tuberculous udders probably the cause of infection	16.0 per cent.
Nothing definite to connect infection with the state of the cow ..	5.2 per cent.

All this goes to show that the ordinary milk supply may be seriously contaminated with the tubercle bacilli, and that even the consumption of the best of milk would render one liable to contracting tuberculosis. It must, however, be borne in mind that the ordinary healthy adult has natural powers of resistance to disease, and that the consumption of milk in the ordinary way would not produce a similar reaction to that obtained by inoculating a guinea pig.

It is interesting to note the following statements of the Royal Commission on Tuberculosis:—"Bovine tubercle bacilli are apt to be abundantly present in milk as sold to the public when there is tuberculous disease of the udder of the cow from which it was obtained . . . but these bacilli may also be present in the milk of tuberculous cows presenting no evidence whatever of disease of the udder, even when examined *post-mortem*. Further, the milk of tuberculous cows not containing bacilli as it leaves the udder may, and frequently does, become contaminated with faeces or uterine discharges of such diseased animals."

TUBERCULOUS MILK AS A CAUSE OF HUMAN DISEASE.

For a considerable period the fact that bovine tubercle bacilli could cause tuberculosis in man was a much disputed point. Koch, the great bacteriologist, in 1901, at the British Congress on Tuberculosis, stated that human and bovine tuberculosis were, for practical purposes, distinct diseases, and that the cases in which human infection results from bovine tuberculosis were so rare that special methods against bovine tuberculosis were not required. Koch's statement led to the appointment of a

British Royal Commission on Tuberculosis, and the general results of their investigations, which extended over many years, unmistakably demonstrated that bovine tuberculosis was a source of human tuberculosis. In their final report (1911) they state:

". . . There can be no doubt that a considerable proportion of the tuberculosis affecting children is of bovine origin, more particularly that which affects primarily the abdominal organs and the cervical glands. And further, there can be no doubt that primary abdominal tuberculosis, as well as tuberculosis of the cervical glands, is commonly due to ingestion of tuberculous infective material." Further on, they state that "the evidence which we have accumulated goes to demonstrate that a considerable amount of the tuberculosis of childhood is to be ascribed to infection with bacilli of the bovine type, transmitted to children in meals consisting largely of the milk of the cow." And, again, "A very considerable amount of disease and loss of life, especially among the young, must be attributed to the consumption of milk containing tubercle bacilli."

Although, as already pointed out, the danger of infection is greatest in children, cases of abdominal tuberculosis of bovine origin often occur in adults.

EXTERNALLY CONTAMINATED MILK.

Apart from the cases just considered above, where the contamination of the milk was due to the diseased condition of the cow, it is quite possible, and very often happens, that the source of contamination lies in the conditions under which milk is produced. Thus, milk from a perfectly healthy cow can be rendered unfit for consumption unless proper precautions are taken to prevent its pollution.

The chief sources of contamination after the milk has been drawn from the cow are (1) in the milking-shed; (2) during transit to the consumer; and (3) on the consumers' premises.

1. CONTAMINATION INTRODUCED IN THE MILKING-SHED.

Undoubtedly the most serious contamination of the milk takes place in the milking-shed, and the results of numerous investigators prove that this is the source of most of the trouble. Reference has already been made to the possibility of the milk becoming infected from persons carrying the germs of some specific disease, and it is only by scrupulous cleanliness and supervision that the danger from this source can be avoided.

It is usually during the actual milking operations that the greatest contamination takes place. The hands of the milker, not even washed to commence with, soon become filthy from the dirt of the cow. The practice of wet-milking is almost universally adopted throughout Australia, being much easier to the milker, and more comfortable to the cow, and it is the usual thing for a thick coating of brown greasy dirt to be accumulated round the thumb and forefinger. From this, dirty drops of milk teeming with bacteria, find their way into the bucket, adding their quota to those already there. It is a common thing to see the flanks of the cows plastered with manure, and it is an easy matter to understand the serious nature of contamination from such a source. As an illustration of the great number of bacteria in manure, the following figures obtained by Orr may be quoted:—

Sample.		No. of Organisms per gramme.
Fresh manure one or two hours old	I.	725,000
	II.	3,500,000
	III.	8,430,000
Old manure cut off from the hardened fæces sticking to the udder and side of legs of the cow	IV.	185,000,000
	V.	13,050,000,000
	VI.	8,649,000,000

It is usually the old excreta which finds its way into the milk, and the variety of organisms is very numerous. It is often advocated that the cows should be kept groomed, but to do this just before or during milking greatly increases the contamination; in fact, any work likely to cause dust, such as feeding the cows, removing manure, or sweeping the shed, should never be done during milking.

At the Queensland Agricultural College the coats of the cows are kept entirely free from manure, and strict hygiene is observed during the milking operation. There, it is customary to moisten the cow's udder and wash her teats with a damp cloth, and the value of this simple operation is greater than one would imagine. Its purpose is,

of course, to prevent the fall of dirt into the bucket, and the result of such treatment in reducing the number of bacteria is shown in the following table:—

Cow.	Number of Bacteria per c.c. in Milk.	
	Cows with Unmoistened Udders.	Udders Moistened.
1	10,160	1,200
2	13,500	3,500
3	200,000	4,300
4	215,000	3,500
5	180,000	2,000
Average	123,732	2,900

Another method of demonstrating the beneficial effect of moistening the udder prior to milking was employed. Sterile plates, containing a suitable medium for bacterial growth, were exposed under the udder of the cow for fifteen seconds, and the plate incubated for seventy-two hours at 22° C. The striking results from this experiment are shown in Figures 1 and 2.

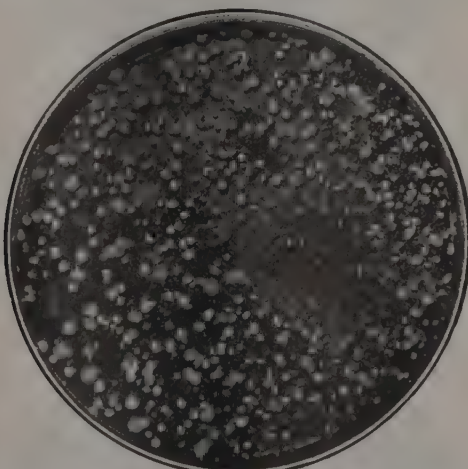


FIG. I.—Agar plate, exposed for 15 seconds under the udder of a cow during milking. Incubated for 72 hours at 22° C. Cow groomed about 14 hours before milking. Number of colonies = 1,350.

Milk vessels when improperly cleaned are also a source of great bacterial contamination to milk. In a series of experiments conducted by Orr, he rinsed out the milk cans with 100 c.c. of sterile water, and then estimated the number of organisms per c.c. of this water.

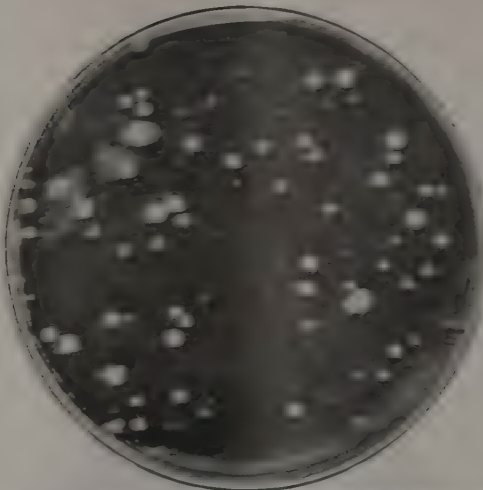
Series A.— Ten samples were examined from cans improperly washed, and gave from 215,000 to 806,320 organisms per c.c.

Series B.—Ten samples, from cans cleaned by washing with tepid water and scalding, gave from 13,080 to 93,400 per c.c.

Series C.—Five samples, from cans cleaned by washing with tepid water and then steaming for five minutes, gave from 355 to 1,792 organisms per c.c.

It is an almost universal practice of the dairyman to strain the milk, usually immediately after milking. It is not properly realised that the ordinary strainer is useless in keeping out bacteria, merely retaining the larger particles of manure, straw, &c. If not kept absolutely clean, if may actually add bacteria to the milk instead of reducing the number. The most efficient strainer consists of one fitted with

[illegible]



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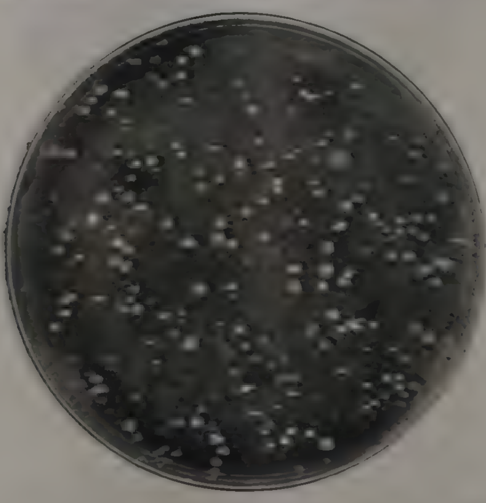

Fig. [illegible].—Agar plate, exposed for 1 minute in the milking shed. [illegible] C. Air of shed still; cows resting. Number of colonies = [illegible]

commonly not easy to steam them. For this reason, all the more care should be exercised in using plenty of boiling water and soap, and steaming all parts that can be steamed.

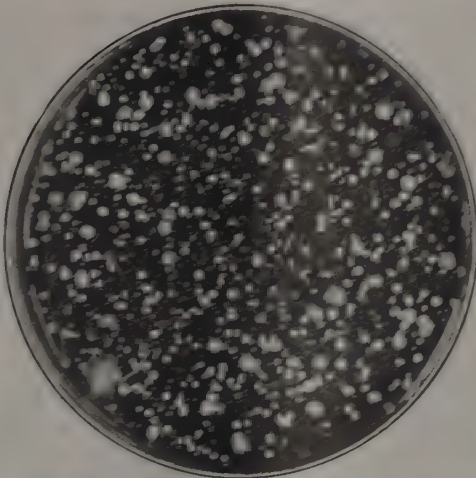

Fig. 4.—Agar plate exposed for 1 minute in the milking shed during [illegible] [illegible]. Incubated for [illegible] [illegible]

The effect of feeding the cows in the milking shed and removing the manure has a marked effect on the bacterial content of the air. To demonstrate this fact, sterile plates were exposed to the air during the conditions as described above. The number of bacteria falling from the air on to the plate in one minute was determined. This method gives a fairly accurate figure for the bacterial content of the air at any time. When the air in the milking shed was still an approximately constant figure for the bacterial content was obtained. During the feeding of the cows and the removal of the manure from the shed, however, the bacterial content of the air was found to have considerably increased. A glance at the photographs of two of the plates as shown in Figures 3 and 4 will demonstrate the above.

USE OF MILKING MACHINES.

In this country, milking machines are extensively used, and in view of the contamination of milk which results from ordinary methods of milking, they have been welcomed by some writers as a solution of the problem. As they are complicated

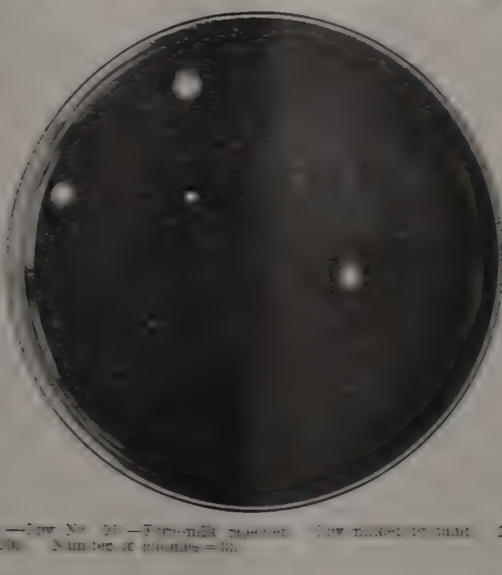

Fig. 5.—Cow No. [illegible].—Fore-milk [illegible]. Cow milked by hand. Dilution of milk 1 in 100. Number of colonies = [illegible].

in construction, and most have a number of long rubber tubes, they are therefore extremely difficult to clean and keep clean, and in the hands of any but the most aseptic-minded persons, are almost sure to be an added source of bacteria rather than the opposite. The following figures will serve to illustrate this point. Samples of milk were obtained from a cow first by hand milking and then with a milking machine, the fore milk being rejected in each case. The milking-machine was looked after by a very careful dairyman, and was kept as clean as it could be under ordinary commercial

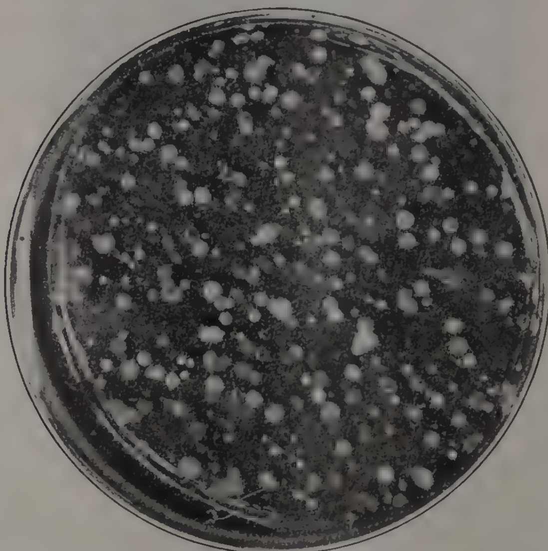

FIG. 6.—Cow No. 10.—Fore-milk rejected. Cow milked by machine. Dilution of milk, 1 in 100. Number of colonies = 2323.

conditions. After suitable dilution and incubation on agar, the milk obtained by hand milking yielded 33 bacterial colonies, while the milk from the same cow obtained by the milking-machine yielded no less than 2,323. (See Figures 5 and 6.)

At Wisconsin University, forty separate trials were made, the cows of the herd being milked continuously by a Burell-Lawrence-Kenedy milking-machine. It was found that the milk from the machine was slightly lower in bacterial content than that drawn by hand. The investigators concluded that "the success of machine milking will depend largely upon the man operating the machine, and on his attitude towards machine-milking."

CONTAMINATION DURING TRANSIT.

The question of transportation of milk from the farm to the consumer is an important one and resolves itself into two problems—1, temperature; 2, protection from contamination. The chief causes of contamination during transit are the use of badly constructed milk cans, the carriage of milk in unsuitable railway vans along with other miscellaneous goods, and undue exposure to dust and sun at railway stations, or on roads where dust is blowing about.

In Australia little or no provision is made for keeping the milk cool in the railway vans, and it is certainly no encouragement to the dairyman to cool it down when he knows that it is to be taken to the city at a temperature of about 80 degrees Fahr. or more. The importance of keeping milk cool cannot be too strongly emphasised, and in this country we should follow the American plan of having refrigerated railway vans for milk only.

In transportation, milk is usually sent in cans, and for practical reasons of economy this seems to be necessary for large supplies, although it would be a far better plan to transport it in glass receptacles if this were feasible. The cans used in transportation should have a tightly fitting cover, which overhangs the top, and thus prevents the entrance of dirt. But those often ordinarily used are themselves the source of much trouble, and the origin of much of the bacterial contamination

of the milk. A glance at the battered, rusty, and dirty milk cans that one finds at a railway station, or at a milk-receiving depôt, will convince him that not a little of the bacterial content of city milk comes from transportation. Of course, the expectation is that these cans will be washed before milk is placed in them again, but battered rusty cans with seams are practically incapable of being washed clean by any method adopted in the ordinary dairy. Cleaner cans, and more frequent replacing of old with new ones, would do much toward improving the condition in which the milk reaches the city. In a paper recently read before the Farmers' Club (Journal of the Farmers' Club, May, 1919), Stenhouse Williams states that the losses due to bad methods of milk production and handling on a supply of 90,000,000 gallons, valued at 1s. per gallon, were not less than £536,000, and the loss due to souring alone on another supply of 75,000,000 gallons was not less than £37,500. These very striking figures show the importance to the milk trade of proper methods of handling and distributing milk, quite apart from any question of public health.

The ideal method in distributing milk to the consumer is to send it out in bottles closed with a disc and covered with a capsule which cannot be removed without tearing. At Toowoomba, the Darling Downs Co-operative Dairy Company is to be commended for following this practice. The delivery of milk in this manner has two great advantages. If properly filled in a clean place, and properly sealed, it prevents contamination during delivery, while it diminishes contamination after delivery. Its disadvantages are, unfortunately, many. The breakage of bottles is considerable, and makes the expense of using them great. Being heavy, a smaller quantity of milk can be carried round by one man. The bottles are also difficult to clean properly.

CONTAMINATION IN THE CONSUMERS' HOUSE.

The extent of contamination which the milk may receive after delivery to the consumer is difficult to estimate. In many cases faults and complaints that arise from him are due to his own carelessness and not to the character of the milk. He places it in a vessel that has not been carefully washed and that still contains some bacteria from the last sour milk which it held. It is then placed in a warm room and allowed to stand for some hours before being placed, if it ever is, in an ice chest. If placed in an ice chest, this is presumably filled with ice, but the ice frequently runs low, and the temperature rises. Under such conditions, especially in summer weather, trouble is sure to follow, and the milkman will receive the complaint that the milk will not keep, when the trouble is due entirely to the treatment from the consumer. For his own advantage, the consumer should be careful to place the milk in a clean vessel, keeping it properly cooled, and free from dust, and particularly from flies during the summer months.

GENERAL TREATMENT OF MILK.

Milk as produced at the present day will not keep fresh for any length of time, due to the fact (as has been demonstrated above) that it is heavily contaminated with bacteria, which multiply rapidly in the milk. The products of those bacteria spoil the milk. Further, we have the fact that a considerable period of time must elapse between the time the milk is obtained at the farm and its delivery to the consumer. To improve the keeping qualities of the milk, and to destroy, as far as possible, the bacteria present, and so lessen the risk of disease being conveyed by the milk, various artificial methods for the preservation of milk have been adopted.

Refrigeration.—The cooling of milk to a temperature of 50 degrees Fahr. inhibits the growth of bacteria to a considerable extent, thus ensuring that the milk shall remain ''sweet'' for a comparatively long time (*i.e.*, about forty-eight hours). It is to be noted, however, that cooling or even freezing does not destroy the bacteria present. Cooling to 50 degrees Fahr. or even lower gives quite satisfactory results, and its universal application is only a question of cost. It is efficient and harmless, there being no evidence that any prejudicial effects on the digestive properties of the milk result from refrigeration.

Pasteurisation.—Pasteurised or ''sterilised'' milk, as it is commonly called by the dairyman, means milk which has been heated to a temperature which it is hoped has killed the bacteria present. Like so many trade expressions, it does not mean what it says, or if it purports to mean it, it is not true, for no such thing as really sterile milk in the bacteriological sense is ever produced commercially. It is impossible to obtain sterile milk without greatly affecting the appearance, taste, and properties of the milk. The usual temperature employed in pasteurising milk is 62.8 degrees Cent. or 145 degrees Fahr., and the ordinary process, if efficiently carried out, kills all the disease-producing organisims, including the tubercle bacilli, so that from this point of view its use in the present state of the milk supply is to be strongly recommended. There are many pasteurising machines, involving different principles, but no matter which kind is used, it is essential that the milk should immediately be

cooled on the completion of pasteurisation, and the risk of allowing it to become reinfected should be prevented.

An objection to pasteurisation is that, although pasteurised milk will sour, it sours much later, and so may be, and in practice often is, kept for a number of days. Old, stale milk may be sold as fresh owing to the removal of most of the lactic acid bacilli. Such milk will appear normal to sight and taste, but may be bacterially highly dangerous, containing many disease organisims.

Again, if used without statutory control, there could be but little doubt that the extensive use of pasteurisation would lead to neglect of general sanitary precautions even more completely than is the case to-day, under the belief that pasteurisation would be an efficient substitute for cleanliness.

THE EFFECT OF HEATING ON THE FOOD VALUE OF MILK.

It is well known that heating milk to certain temperatures reduces the activity or completely destroys certain enzymes or ferments naturally present in milk, and much controversy has arisen as to whether heating milk, as in pasteurisation, alters it sufficiently in composition to affect its value as a food for infants and young children. The subject has been submitted to direct experiment, and on the whole it would appear, taking all the facts into consideration, that there is no satisfactory evidence to show that cooked milk is either less easily digested or less easily absorbed from the intestine than raw milk. The loss of nutritive value by heating is also negligible.

It has been frequently asserted that boiling or otherwise cooking milk deprives it of its antiscorbutic properties, and that such milk is the cause of infantile scurvy, rickets, &c., but it is difficult to find definite evidence in favour of such an assumption. Considering our present state of milk supply, the advantages to be gained by pasteurisation would seem to far outweigh the supposed disadvantages.

STERILISATION BY ELECTRICITY AND USE OF ULTRA-VIOLET RAYS.

Beattie and Lewis, of Liverpool, have of recent years conducted experiments with a view to ascertaining the destructiveness of electricity on the bacterial cell, and its application for the practical purpose of sterilising milk. The milk is passed through a tube provided with copper electrodes, between which a high tension current of from 2,000-3,000 volts is passed. The destruction of the bacteria appears to be satisfactory. B. coli and allied organisims were completely destroyed. The cost (1916) varied from 0.85d. to 1.25d. per gallon according to the source of power employed. The use of ultra-violet rays for sterilising milk has also been advocated, and although most effective in destroying the organisims present in milk, the cost of doing so is prohibitive, making the use of these rays commercially impossible.

CONDENSATION AND DRYING.

A brief mention of the condensation and drying of milk will be made here, for this treatment of milk plays an important part in solving the city milk supply. Delépine (Reports to Local Government Board on Public Health and Medical Subjects No. 21) investigated the effects of these methods on the bacterial content of milk, the following three processes being specially studied:—

1. Manufacture of sweetened condensed milk;
2. Drying milk over heated revolving cylinders;
3. Drying milk by spraying it into a current of hot air.

It was found that by the adoption of these methods a considerable reduction in the number of bacteria present in the milk took place, this reduction being greatest with the first and least with the last method, where a considerable amount of contamination took place after the drying.

It was observed that at all stages of the drying of the milk some bacteria remained alive, the tubercle bacillus being among them; but, although the number was higher than could be desired, the vitality of the organisms appeared to be so lowered that they were incapable of producing tuberculosis when inoculated into young rabbits.

If milk retained its desirable qualities after the drying process it would to a large extent solve the difficulty of our milk supply problem, and housekeepers would be able to always have a supply on hand. From their point of view it would prove most economical, the requisite amount being used as required, and its use would solve many of the problems of contamination. In Australia milk-powders are more than ever coming into daily use, some in the form of patent foods for infant feeding, and, although no details have been furnished, the general reports on their uses submitted to the conference on infant mortality held in London in 1913 were quite favourable.

BACTERIOLOGICAL STANDARDS.

At first sight it would appear that the difficulty of providing a pure milk supply could be obviated by the adoption of a standard of cleanliness, whereby every dairy farmer would be compelled to supply milk conforming to the number of bacteria allowed by the standard. It has often been proposed that the sale of milk containing more than a specified number of bacteria should be prohibited, but as the average milk when delivered in the city contains from 100,000 to 1,000,000 and more organisms per c.c., it is not an easy matter to decide on the number which shall constitute the standard. The standard proposed by many varies from 10,000 to 50,000 organisms per c.c. but, as the fitness of the milk for human consumption depends obviously not merely on the number of bacteria present, but on whether the milk contains disease-producing organisms or not, it can clearly be recognised that the establishment of a *numerical* bacteriological standard would prove of little value from a public health point of view. At present, only in a few places has the attempt been made to establish such a standard. Boston has tried to enforce a standard of 500,000 per c.c., while it is to be doubted if New York could reach 1,000,000. Many of the smaller towns in America have much lower standards, milk of a high quality of purity being sold under the name of "certified milk," produced by agreement between certain societies of medical men and dairy farmers. The milk is produced under most stringent aseptic conditions, and is submitted to regular bacteriological examinations, to ascertain whether the number of bacteria exceeds the standard of 10,000 per c.c. of milk. It follows that such milk costs more to produce than ordinary milk, but, in spite of this, it finds a ready market. The introduction of a system of grading, both as to quality and purity, is much needed in Australia, and the higher price obtainable for better quality of milk would act as a stimulus to the dairy farmer, encouraging him to improve the quality of his product. Our present system of selling milk at more or less the same price irrespective of quality or purity cannot be justified.

GENERAL.

It is not sufficiently realised that the production and distribution of pure milk is an industry requiring a highly intelligent set of workers, and most careful and thorough management. There is much need for a further education of those who produce and handle the milk as well as of those who consume it, and although the education given at our agricultural colleges in different parts of the Commonwealth is undoubtedly admirable for those who are going to become expert cheese and butter makers, or instructors, it does not reach a large proportion of those actually engaged in the handling of milk. The short six weeks' course given at Gatton College is excellent, and it is a matter of regret that more farmers or their sons cannot avail themselves of such instruction. Splendid work is being carried out by the Government Dairy Inspectors, their duty being to see that the conditions under which milk is produced on the farms conform with the legal requirements of the State, and to give advice to dairymen on the best method of producing clean milk. This Government supervision is necessary, for the idea that the average dairyman will of his own accord, without outside pressure, supply a clean milk instead of a manure-laden one, cannot be seriously entertained by those who have extensively discussed this matter with him. The writer has met a few dairymen who understand and appreciate the need for sanitary cleanliness, but very few compared with the number who regard such precautions as a silly fad. The great majority take refuge in the following argument in turn:—First, that they do take all necessary steps, and that practically nothing does get into the milk. Confronted with milkers with filthy hands, and with still filthier cows, they abandon this argument for the next, which is, that if anything does get into the milk the strainer removes it all. Strainer, with much gross manurial filth removed by it from the milk, produced in triumphant confirmation. With the significance of this explained to them they fall back upon their final plea, that perhaps manure does get into the milk, but it does not matter, and they milk like their fathers before them, and what was good enough for their fathers is good enough for them. The latter may be a true statement, but, as is explained to them, that is not the point, which is whether it is good enough for the milk consumer who may not desire what their fathers had. Their fathers had a heavy incidence of infectious disease, a heavy tuberculosis mortality, and always a high death rate. These are not good enough to-day. It is difficult to see how the reforms mentioned above are to be carried out effectively so long as the retail distribution of milk is in so many hands as it is at present. Our present methods are economically unsound, and render anything like adequate supervision and control quite impossible. A much greater organisation and centralisation of the distribution of milk is absolutely necessary, and without any exaggerated belief in the virtues of municipalisation, the writer is convinced that until some such action is taken our milk supply will remain very much as it is at the present time.

Horticulture.

THE IMPROVEMENT OF CULTIVATED PLANTS.

Lecture delivered at the Horticultural Society of Queensland's Show on 20th March, 1920, by Mr. R. W. Peters, Director Queensland Acclimatisation Society.

Probably no question is of so much interest and importance to horticulturists and farmers as the improvement of cultivated plants. Since the time of Mons and Knight this phase of plant culture has received considerable attention, but probably much less than it deserves. The experience of plant-breeders the world over has shown clearly that the possibilities in the improvement of useful plants are unlimited. The last half-century has witnessed huge extensions of the areas devoted to agri-horticulture, and this has led to a demand for new varieties of cultivated plants adapted to particular conditions of soil and climate, immunity to disease, &c., and, again, the maximum productiveness of most of our cultivated plants has not been reached, and much can still be gained in this direction in attempting to produce improved varieties.

There are several methods by which cultivated plants may be improved, the most important being by hybridisation, others being by sports, variations, mutations, and selection.

Few more agreeable occupations can be found for an amateur, and few more profitable for a professional in horticulture than that of creating new varieties of flowers, vegetables, and fruit, which shall be more productive and more beautiful than those now found in gardens.

For professionals who desire to make a commercial enterprise of plant-breeding there is one difficulty: they must know the varieties and species, &c., already in the trade of the genera which they undertake to improve. It is desirable, when attempting to secure new varieties, that one specialises in one particular genera, that being the way followed by many of the most successful horticulturists. One might take up roses, gladioli, petunias, carnations, or tomatoes, beans, peas, &c.

As an example of the methods adopted in the improvement or creation of new varieties I will take, firstly, the rose.

The old-time method of raising new varieties of roses was to indiscriminately collect from the nursery or collections all fruits obtainable, without paying any attention to the varieties which produced them. The rose fruits thus gathered were sown in pans or seed-beds and afterwards transplanted into nurseries. If, out of one thousand seedlings, half a dozen noteworthy new varieties were found, the raiser was well satisfied.

Naturally, under these conditions many variations were found, such as length of time taken to produce first flowers; some were single, semi-double, and double; some would bloom abundantly, and some scantily.

To understand how ordinary seedlings of roses cultivated in gardens could produce anything profitable, one must remember that many of them are descendants of cross-breeding. Now, it is well known that plants descended immediately or distantly from crosses or hybrids do not come true from seed unless fixed to type, which is seldom done in plants reproduced vegetatively. They are endowed with innate variability, characters separate combine to produce others, and run through a whole circle of variations which manifest themselves in various ways.

Simple propagation by seed is only recommended with separate varieties, and to follow the results by pedigree culture to the third generation. Pedigree culture offers two advantages: first, the planter is not required to waste time sowing seed from plants which produced nothing good in the first generation. If he does not want to carry his experiments any farther, he knows that he has missed nothing good so far as he has gone, but if he has the instinct for plant-breeding, he may find in succeeding generations, if not good novelties, at least good seed-bearers or pollinizers—that is, good mothers and fathers, often fairly semi-double, with which he can make productive crosses.

Good pollinizers or producers are rarely put in the trade by their originators, who keep the monopoly for themselves.

When taking up hybridising and cross-breeding one must remember that Nature has set a limit to the enlargement of flowers, to their florabundance, &c. Large size in flowers is more often obtained by using those of medium size than by using large flowers to commence with, unless the latter are semi-double. Too much duplication of petals is to be avoided, as the flowers do not open well. But double roses, when they possess good pollen, can be utilised to advantage as males on good semi-double females.

There are plenty of cases where beautiful roses are absolutely sterile, and with such it is waste of time to pollinate them, but if they possess good pollen, it may be used on other females.

There are few genera where artificial pollination is easier to perform than with the rose; its flowers are large, its stamens numerous, and its pistils easily seen. Furthermore, natural pollination rarely takes place before the flowers open. The organs of the rose are very simple; the calyx and petals are known to everyone. In the centre of the flower are the organs the plant-breeder needs to know, the stamens formed of threads carrying anthers—small yellow points containing pollen. These are the male organs. Finally, these are the styles sometimes united, often crowded together; these styles are terminated by a stigma at the apex, and an ovule or seed vessel at the base. It is on these stigmas that the pollen falls and fertilises the ovules.

To make a cross pollination, the rose to be pollinated, *i.e.*, the mother plant, should first be deprived of its stamens and the petals of the centre of the flower, in order that they may not interfere with pollinating operations. The emasculated flower should then be bagged to prevent fertilisation by insects. When the stigma becomes mucilaginous, pollen from the selected male parent should be placed carefully on the stigmas by means of a camel's hair brush. If many pollinations from different varieties are to be made, care must be exercised to thoroughly clean the brush by using a 40 per cent. solution of alcohol. The cross-pollinated flower should then be rebagged.

The ripened fruit should be sown separately in each variety, in pans, and brought to two or three generations.

In crossing a new type with single flowers, which is to be used as a polliniser, it is desirable to choose a fertile mother with double flowers and whose ancestors were double.

Lastly, roses give an excellent example of what is termed "bud variation." Every rosegrower knows that many of our varieties called climbing roses are varieties whose mothers were not procumbent by Nature, and that such varieties can be almost produced to order by taking buds from branches which show a tendency to extend; such extension can be stimulated by pruning, manuring, and a partially shady position. Bush roses can be produced in the same way by taking budwood from the neighbourhood of the inflorescence. Examples—William Alan Richardson, Mrs. W. J. Frost. Roses of hybrid origin are most likely to throw bud sports, and a grower who cultivates hundreds of each variety has an excellent opportunity of watching for branches or whole plants presenting characteristics worthy of being fixed, more abundant flowers, lighter or darker shades of colour, better foliage, or fewer thorns. How many sports are lost because not noticed.

BREEDING NEPHROLEPIS FERNS.

Ferns of the genus Nephrolepis can be divided into two groups, on the basis of their genetic behaviour; first, those which show variation only when propagated sexually by spores; and second, those which produce new varieties asexually.

The first group includes more than ninety species and varieties, all of which are either found growing wild or have been produced from spores by breeders. Of these may be mentioned the following commercial varieties: *Nephrolepis exaltata, cordata, compacta, plumosa, dovallioides,* and so on.

The second, and more interesting, is limited to the Boston fern, *Nephrolepis exaltata bostoniensis* and all its sports, of which there are many.

In a natural state ferns are often hybrid, the sexual organs being so located as to almost completely prevent self-fertilisation. The spores, found in large numbers as kidney-shaped, brown, fruiting bodies, on the under side of the leaflets, produce occasionally new forms when sown.

The ferns of the second group, that is, those derived from the asexual varieties, may also be propagated from spores, although by some these are considered sterile.

Most of the commercial varieties of *Nephrolepis* are sports of *N. exaltata.* This variety probably originated near Boston some thirty years ago. The first recorded

sport of commercial importance occurred about 1898, and since then there have been produced over sixty-five commercial varieties.

In order to produce new types, it is necessary to raise a large number of different varieties. This can be profitably practised by persons who are engaged in growing ferns on a large scale, because they have under their observation a large number of plants growing for market. The plants, during their development, are closely examined, and those which show a tendency to differ in foliage or in habits of growth are isolated.

These variations, such as are found among ferns, may occur in a portion of a frond, or on the stem or rootstock, or on the runners. The only variations which are of value to the breeder are those which can be isolated. For instance, there is no way of isolating a variation which occurs on a portion of the leaf.

Sports which are commercially utilised and which are easiest to isolate are those which appear on some portion of the runner, where new-rooted fronds are produced.

The following are a few of the characteristics to be considered in the merit of a new fern. The plant must be either an improvement over another form, or be a class by itself. Rapidity of growth is a factor which concerns chiefly the wholesale florist. There are three growth characters which are desirable. In the first place, the fronds should develop rapidly; numerous buds should arise in the central area of the plant to give it a dense form; and finally, it should send out runners freely. Not less important is the uniformity of the size and shape of the smaller leaves known as pinnæ; the plant should show no tendency to revert or show any variation in any part of the leaves.

The questions of sports and variations have both been mentioned in this paper, but there still remains mutation and selection to deal with.

Mutations are conditions in plant life which in some cases occur suddenly, much in the same way as bud variations do. Moreover, this phenomenon is stated to occur at one particular period of the life of a species, and is confined to certain forms. The species may exist for years without any material change, and then all of a sudden the plant may enter upon a period of "mutation," new forms being developed. Why, how, and under what conditions this sudden change occurs is not explained. The best example of a mutant is the evening primrose, *Œnothera lamasckiana.*

Selections.—When growing large quantities of a certain crop, as, for example, flax, by taking careful observations, differences will be noticed. Some few plants may have a more branched flower head, and others may have a better unbranched length of fibre, and by careful selection and growing on of these slightly better factors, a crop of more commercial value may be obtained. Many cereals have been very much improved in this way.

SOCIETIES, SHOW DATES, ETC., 1920.

GLADSTONE.—Port Curtis Agricultural, Pastoral, and Mining Association. Show dates, 25th and 26th May, 1920. Secretary, J. T. W. Brown.

BEENLEIGH.—Agricultural and Pastoral Society of Southern Queensland. Show dates, 23rd and 24th September, 1920. Secretary, F. H. Wuth.

WALLUMBILLA.—Wallumbilla Agricultural and Pastoral Association. Show dates, 25th and 26th May, 1920. Secretary, F. C. Hawes.

TOOWOOMBA.—The Royal Agricultural Society of Queensland. Secretary, G. Noble. The annual exhibition will be held on 20th, 21st, and 22nd April, 1920.

NANANGO.—Nanango Agricultural, Pastoral and Mining Society. Show dates, 12th and 13th May, 1920. Secretary, G. Lee.

WONDAI.—Wondai Agricultural, Pastoral, and Industrial Society. Show dates, 19th and 20th May, 1920. Entries close on 3rd May. Secretary, G. D. Griffith.

ORALLO.—Orallo Branch of the Queensland Farmers' Union. Secretary: Ern. A. Thomas.

MACKAY.—Pioneer River Farmers and Graziers' Show Association. Consequent on the resignation of the late Secretary, Mr. Frank Black, Mr. Ralph G. Johnson has been appointed Secretary to the above Association.

Entomology.

I.—THE BANANA WEEVIL *(COSMOPOLITES SORDIDA, Chevr).*

(Plate 13.)

By HENRY TRYON, Government Entomologist.

Introductory.

This banana-injuring insect, whose original home is unknown, is not a native of Australia. It has been found in Brisbane in banana plants from Jamaica, Ceylon, Singapore, Philippine Islands, Fiji, and Papua. Indeed specimens were received from British New Guinea already in August, 1887.

For at least twenty-five years, however, *Cosmopolites sordida* has been present in this State, having been met with, in May, 1896, at Mackay in banana plants (it was said) from Brisbane. Actual specimens from the latter locality were not, however, obtained until 1899.

In 1896 the Department of Agriculture secured the proclamation of a stringent regulation under the Diseases in Plants Act of that year, aiming at its further exclusion.

Since 1896 its occurrence at Mourilyan, Mount Jukes Mackay, and at several places, between Gympie and the Tweed River inclusive, on the east coast has been established.

In addition to the insect under consideration, a second banana weevil, *Metamasius hemipterus*, Lin., has occurred on banana plants here on their arrival from Jamaica.

The banana weevil may be found in association with the banana in all its four different life phases, *i.e.*, egg, larva, pupa, and beetle.

Description.

The Adult or Beetle (Plate, figures 4 and 5, 4*a* and 5*a*).—This resembles generally in form the ordinary grain weevil, but is many times its size. It is black (chestnut brown when young), dull—having a thin grayish surface incrustation—when abraded, glossy otherwise. The three divisions—head, mid-body, and hind-body—are very distinct. The two latter are of about equal length; the hind-body measures about 1½ times that of either of them. The wing-covers (elytra) have numerous low ribs, each separated by narrow furrows (punctured striæ) from its fellow. The true membranous wings folded beneath them are well developed, greatly exceeding these wing-covers in size and length. The mid-body, bowed on each side, is covered above by numerous minute points. The head is sunk in the mid-body to the middle of the eyes, and has a long narrow downwardly curved beak or proboscis (rostrum). The feelers (as usual in weevils) are elbowed. The legs are stout, and have a sharp curved spur or thorn at the end of each foreleg. The sexes are nearly alike; the female weevil, however, has the proboscis slightly longer and narrower than occurs in the male. Length, 9 mm. by 3 mm. to 14 mm. by 4½ mm.; average size, 12 mm. by 4 mm. (*Note.*—1 millimetre (mm.) = 1-24 inch.)

The Egg (Plate, fig. 1 enlarged).—This is minute, pale-yellow, regularly oval, and measures $1\frac{3}{10}$ mm. long and $\frac{6}{10}$ mm. broad.

The Larva or Grub (Plate, Fig. 2).—This is white, fleshy, soft, and legless. Except for the presence of a few hairs at each end and on its thorax, it is naked. The head is light-brown. The shield on the first segment of the body beneath is colourless, however. Deep wrinkles cross the body above, and the eleven true body segments are recognised by divisional lines beneath. The body is not of even girth, but suddenly swells out beyond the fifth segment to a width of more than twice what it is before; then it suddenly narrows to a round projecting hind-segment. The larva attains a length of 20 mm. and a width of 8 mm.

The Pupa (Figure 3) is naked, and at first yellowish-white. It reproduces the appearance of the beetle—the proboscis, its feelers (antennæ) bent back, the limbs folded up, the wing-covers and wings elongate pad-like. The divisions of the hind-body—now uncovered by the wing-covers—are very distinct; whilst this also ends squarely in four little projections above and two spine-bearing cushions beneath. Its length is ½ inch.

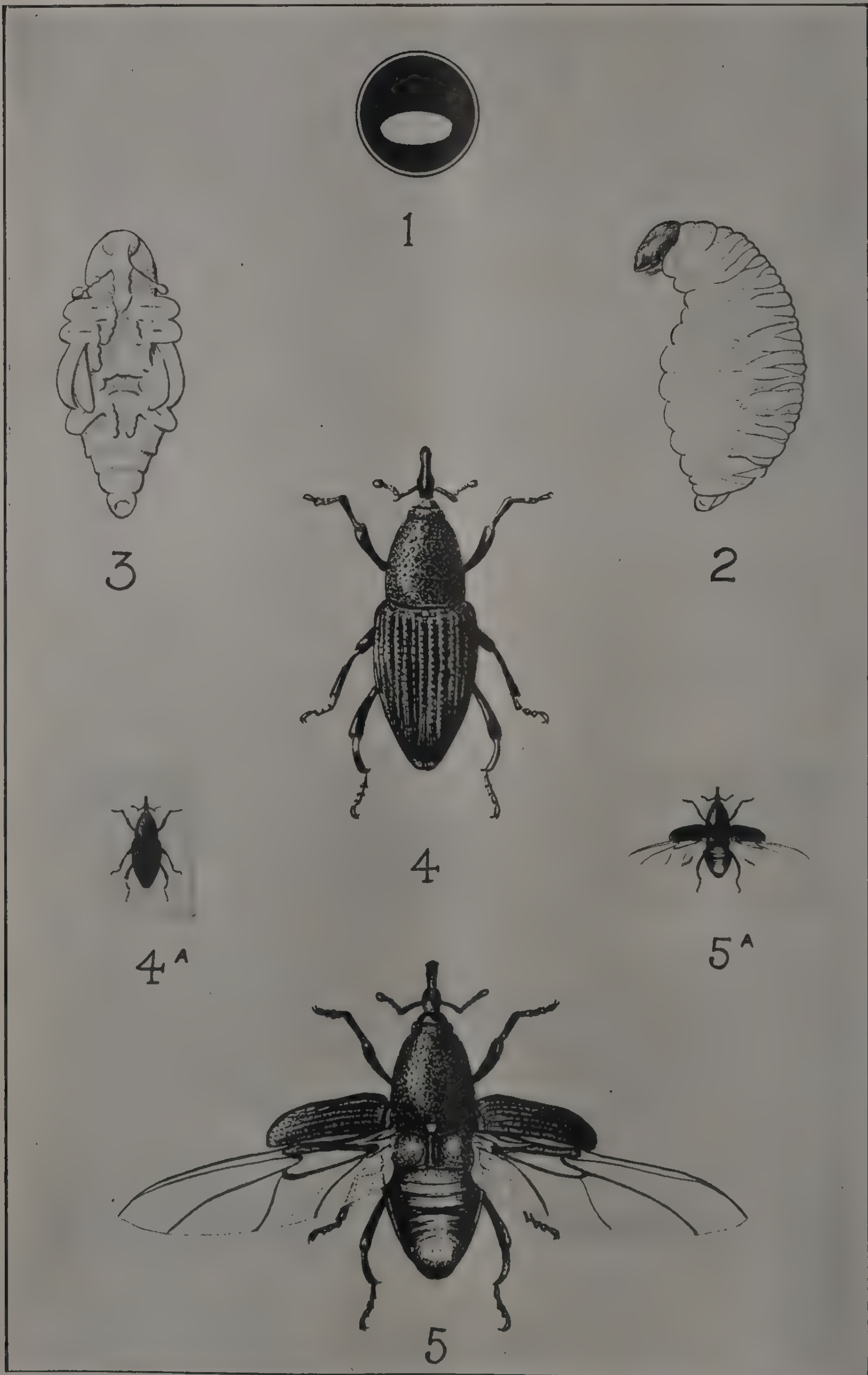

PLATE 13.—THE BANANA WEEVIL (*Cosmopolites sordidus*), Chevr.

1. Egg (magnified). 2. Larva or Grub. 3. Pupa. 4 and 5. Beetle or Adult—4, with wing covers closed (magnified); 5, with wing covers open and wings extended (all as magnified); also 4 A and 5 A, same (natural size)

HABITS.

The beetle favours situations that agree with it in general colour and so lend their assistance in its concealment. These are usually in or on the banana near the ground. It is nocturnal in its movements, or at least principally active after sunset. Assisted by hook-like processes at the ends of its forelegs, it clambers in or out of less exposed places in the banana-stool or stem; whilst it uses its ample wings in flying through the air. When disturbed it draws in its legs, and becomes motionless, relying for protection on its colour and hardness. It moves about principally when in quest of food for itself or suitable places for the subsistence of its young (the larvæ). Its food appears to consist principally of the fermenting juices, developed upon cut-surfaces of the bases of suckers or in other portions of banana plants that have commenced to decay; but it rends into small fragments portions of the starchy corm, feeding on this also. In its migrations it will visit even plants (suckers) already packed for delivery, and lay its eggs in these. These eggs are deposited singly, and placed upright in little cavities or holes, excavated by aid of the jaws terminating its "snout," by the parent beetle. The minute size, colour, and isolated occurrence of these eggs render their detection in the field impracticable generally, even by the trained observer. From observations made by H. Jarvis, it would appear that each female beetle at a single period lays 14 eggs or less—usually from 9 to 11. Individual beetles are, however, long lived, their existence being extended to months; and, apparently, as happens with other beetles, at intervals successive batches are laid.

The larva, on hatching out, mines in the living tissue of the banana root-stock or corm, its tunnel being approximately circular in section, and moreover filled with particles of food that it has rejected. At first this tunnel is very small and inconspicuous: for in fact, since little or no air can get access to its walls, these do not discolour, and so assist in making it otherwise. As, however, the "grub" attains full size, its mining and feeding take place nearer the surface than before; and, therefore, not only now have the tunnels become much wider, but being exposed to the air the surrounding tissue may have blackened and partly broken down; and this occurrence, and the presence, too, of abundant sawdust-like particles, renders detection of this insect attack now evident enough.

After living as a larva for about three weeks, a small oblong chamber is gnawn out by the insect, usually just beneath the surface of the root-stock, but at times further within; no true cocoon is, however, fashioned by it. Here it comes to rest and, casting its skin, becomes a pupa as described.

And after six to eight days spent in this resting stage of the pupa, the insect now gives rise to the adult or beetle. This beetle may not, however, break its way out—the next step taken—for some days; whilst meanwhile its soft body, at first quite pale-coloured and delicate, becomes of a darker and darker chestnut, and more and more robust, until finally it is black, and of special rigidity.

Arrived thus at the final stage in their development, the sexes mate, and in due course lay their eggs on the banana plant that has witnessed their appearance or on other ones or parts of ones more or less distant from it.

Flying, taking place at night, is not directly observable. On two occasions we have found the beetle at a distance from any banana-cultivation. But evidently the insect does not fly far as a rule, when occurring where the banana already grows and it can exercise its mating habit.

Since five or six weeks only are occupied in the passage from egg to mature insect or beetle, there is time for several broods of weevils to be produced during the summer months alone; a fact known to occur.

No visible injury, or effect on growth, may be realised until the plant in which the beetle is established harbours many insects. The presence of the Banana Weevil may therefore for a while escape detection.

DETECTION OF OCCURRENCE.

When present in some numbers, the banana-plant in which the weevils or weevil larvæ occur may exhibit the ordinary symptoms of poverty and arrested growth, notwithstanding many insects may occur in a stool without any such symptoms being shown. At the same time other injurious agencies may produce similar effects. A tall-growing banana, *e.g.*, lady's finger or sugar banana, under severe attack, may, however, topple over; so again many young and recently set-out plants die where they have grown.

As a general rule, it will be noted that affected plants are "suckering very badly," or not suckering at all.

These indications should suggest cutting away slice by slice downwards the old stool whence these suckers arise; or similarly removing parts of the root-stock of the sucker itself, when—if the insects are present—their workings, as described above, may sooner or later be discovered. So also specimens of the banana weevils themselves, in one stage or another, of their growth.

However, when inspection is restricted to the suckers alone, and attack by the insect is of recent occurrence, it is not practicable to decide from such inspection whether they be weevil-infested or not.

Portions of banana plants and of the corm (rootstock) especially, detached suckers, and in some instances these on being planted even, whenever occurring within the range of the adult beetle, will attract it and serve it also in raising its progeny. Thus, too, they may act as a means for early discovering its presence.

This remark, too, applies to the material occurring at the base of banana stools.

Addendum.—Since there are several beetles (*Sphenophoridæ*) occurring in Queensland that more or less closely resemble the one herein dealt with, banana-growers who may encounter an insect that they regard from the foregoing description and figures as being the depredator in question, should take steps to verify their conclusion, submitting to this end a specimen or specimens to the Entomologist for identification.

REMEDIES SUGGESTED.

By ALBERT H. BENSON, Director of Fruit Culture.

These are either precautionary or for the definite purpose of destroying the beetle in any form in which it may exist.

PRECAUTIONARY MEASURES.

These must on no account be neglected, as it is easier to keep the beetle out of a plantation than to exterminate it once it has established itself. Growers should therefore take the greatest care to see that the suckers they plant are perfectly free from the beetle in any stage of development, and be satisfied that there are no beetles in the plantation from which they are obtaining them, or in the district in which the plantation is situated. The Diseases in Plants Act provides that no banana suckers can be sold in which the beetle is present, and growers are warned that, if they dispose of such, they render themselves liable to prosecution. At the same time, the intending planter should examine every sucker separately and thoroughly as soon as he receives them, and if he has the slightest suspicion that a sucker is not perfectly sound, he should destroy it at once.

DESTRUCTION OF THE BEETLE IN INFESTED PLANTATIONS.

1st. Where the Banana Plantation is Badly Infested.—There is only one remedy—total destruction.

2nd. Where the Infestation is Slight.—Every infested stool must be taken out and destroyed, and the beetles systematically trapped by placing a number of traps (which consist of fully developed bulbs or corms cut in half and placed cut side down on the ground) around the infested stool or stools, and collecting the beetles attracted to the traps at frequent intervals. If this work is well carried out, the plantation will continue to yield good returns of fruit for two or three years, but eventually the whole of the plants must be taken out and destroyed. No suckers may be removed from the plantation.

HOW TO DESTROY INFESTED PLANTS.

So far, the only effectual method of destroying infested plants is to dig out, chop into small pieces, and make them into a compost heap with fresh horse manure or chopped green grass or weeds, so that the mass will undergo fermentation, and generate enough heat to kill the beetles. Burning is out of the question, as the corms are very hard to burn, and the cost is too great. Chopping into small pieces and laying them on the ground to dry up is being tested, but wherever practical the compost heap is preferable, as the refuse forms a valuable dressing for the soil. The greatest care must be taken to destroy every part of the plant, and leave nothing for the beetles to feed upon, as the only way to be certain of exterminating them from any area is to destroy as many as possible and to starve out any that may escape.

CANE GRUB INVESTIGATION.

The General Superintendent of the Bureau of Sugar Experiment Stations has received the following report upon cane grub investigations for the month of February from the Entomologist, Dr. J. F. Illingworth:—

Cane farmers in North Queensland certainly have their full share of difficulties to contend with—a fact one does not fully appreciate until he tries to grow cane himself.

After passing through an unprecedented drought, which, where it did not kill out the cane entirely, retarded its growth many months; then the rains, when they did begin, were accompanied by a cyclonic storm of such fury that the remaining crop was laid flat on the ground.

Naturally, these vicissitudes and difficulties experienced by the growers have seriously affected experimentation, setting my work back practically a whole season. As stated previously, the experiments with arsenic I have had to limit to ratoons.

Mr. Dodd, who was stationed at Greenhills during the whole emergence of the beetles, was able to make some interesting observations, for the pest came out, on that estate, in great numbers, in spite of the extended drought.

EMERGENCE OF *LEPIDIOTA ALBOHIRTA*.

As I had anticipated, the flight of beetles was rather meagre at Meringa, and did not last long. Unexpectedly, however, immense numbers emerged at Greenhills, where the soil is of a loose, friable nature. Though the crops there suffered severely last year, I expected that the continued drought would give them a serious set-back, for the majority of them have to wait for the heavy rains before they are able to dig themselves out, since their pupation chambers are usually at a depth of several feet.

The first specimens that emerged were badly rubbed and worn—evidently those that pupated near the surface, where they suffered from the extreme dryness. A good many of these were seen dead on the surface, where they had succumbed soon after emergence.

Evidently the soil in the lower levels retains enough moisture to carry the beetles over severe droughts safely, where their pupation chambers are deep enough. It appears to be their nature to go deep for this very reason—they have been found at depths of 6 feet, or more; the majority pupating at 2 to 3 feet. In rare instances, however, in localities where the fields were wet at the time of the submergence of the grubs, I have found them pupating only a few inches under the surface, where they are easily turned out by the plough.

OBSERVATIONS ON FLIGHT OF BEETLES.

By working early and late, Mr. Dodd was able to formulate definite conclusions upon the movements of the beetles. After emergence from the soil, which takes place at dusk, the beetles flew about rather erratically at first, but the general movement was toward the feeding trees, even when a light breeze was blowing from that direction. They appear to know instinctively where to go.

Later, in making observations to determine when the beetles return to the cane to oviposit, Mr. Dodd found that this flight invariably takes place in the morning, just before daybreak. At this time there was no breeze blowing, but it is interesting to note that the beetles flew directly into the cane, following the general direction of the prevailing winds, *i.e.*, from the south-east and east. This may be only a coincidence, but it agrees with our former observations as to the distribution of the infestation, as shown on sketches of both the Greenhills Estate and the Gordonvale Farm, published in Bulletin No. 8.

The beetles invariably settled on the cane, and remained perfectly quiet for a considerable period—none of them eating or attempting to enter the soil. Later in the day, however, Mr. Dodd saw one drop off and dig itself in; so, evidently, as the sun warms up they seek this seclusion.

Beetles collected under these conditions all proved to be females; and dissection showed that they were weighted down with between two and three dozen fully developed eggs.

LEPIDIOTA FRENCHI ACTIVE.

As indicated in last report, this species appears to be on the increase in cane areas. In fact, these grubs have appeared this season in fields never before infested. This being especially true in old forest lands, with rather heavy clay soils, which have always been considered immune.

ARSENIC (ARSENIOUS ACID) FOR CANE GRUBS.

During the month I have started extensive experiments, both at Greenhills and at Meringa. In the case of ratoon cane, I had furrows opened up with a pony-plough, along each side of the rows, and as near to the stools as possible. The poison was then dusted into these, and they were filled with the scarifier before the roots had time to dry out. By this method the poison is placed where the young grubs can readily find it when they begin their activities, and, I hope, before they have time to do serious damage to the cane roots.

Methods of application of the poison have been under investigation, and it will be of interest to record our results. I first thought of using a machine on the plan of the corn-planters; but this was soon found to be impractical for distributing such small amounts, especially as I desired to scatter the poison evenly on both sides of the row.

Working on the plan of that used in the Southern United States for dusting arsenic on cotton plants, I rigged up tins with fine sieve bottoms, and attached each to a slender, upright stick, about 4 feet in length for a handle. This enabled one when walking beside the row to hold the tin just over the furrow, and by constant tapping upon the stick handle to dust the poison evenly.

We found that the amount distributed could be easily regulated, both by the vigour of the beating upon the handle and the rate at which one walked. In practice one can easily apply 20 lb. per acre when walking at a rapid rate; and, by going slowly, and beating harder, it is not difficult to put down even 80 lb.

In these experiments I used arsenic at the rate of 20, 40, 60, and 80 lb. per acre, hoping to secure conclusive results.

It will be recalled that in my laboratory experiments with arsenic, grubs died very quickly when placed in pots of soil containing minute quantities of this poison. This is explained, because it is their habit to constantly ingest quantities of soil, absorbing the organic matter from it. In fact, it is recognised that they prefer this method of feeding, unless forced by the poorness of the soil to feed upon living roots.

THE CABBAGE MOTH.

"This very destructive pest," writes Mr. C. French, Government Entomologist, Victoria, "is one that causes an immense amount of damage; and among market gardeners throughout many parts of the world the losses occasioned through the attacks of these insects are enormous." In his valuable work, "Handbook of the Destructive Insects of Victoria," he says that the "Cabbage Moth," "Diamond Back Moth," and "Green Worm of Cabbage" are one and the same insect. The eggs, which are of a dirty-white colour, are deposited in large numbers on the leaves of cabbages, on turnips, and other plants of the same natural order. They are also found deposited on the sides of crates in which cabbages and cauliflowers are packed for transport; and this is a constant and fertile source of danger in the way of carrying the pests from one place to another. The caterpillar is less than half an inch in length, green in colour. Mr. H. Tryon, Government Entomologist, Department of Agriculture in Queensland, says it is found throughout the whole world from Greenland to New Zealand and Australia. The outer leaves of the cabbage are the most affected, but Mr. French says that he has found the grubs in the very centre of the heart, but the cocoons are mostly found on the outer leaves.

As to prevention and remedies, a commencement must be made with the young cabbage or cauliflower plants whilst in the seed beds, and again before being finally planted out into permanent positions.

It would appear from the English "Gardeners' Chronicle" that one of the cheapest and most effective remedies is to take 1 lb. of coal-tar and boil it in a couple of gallons of water, and when boiling, dilute, in the proportion of two gallons of the liquid, as taken from the boiler, with 100 gallons of fresh water. Brackish water should not be used. Having diluted it, it should be well stirred, so that the water may become impregnated with the tar flavour. Water with a fine-rose watering-pot the beds in which the plants are growing; tar, in any form being very obnoxious to insects in general, and to small grubs in particular.

A weak kerosene emulsion, say, 1 part of emulsion to 25 or 30 of water, though, this, of course, is more expensive.

Before applying the tar water or emulsion, care must be taken that the plants are not previously disturbed, otherwise many of the grubs may absent themselves only to crawl up the stems after the danger has passed.

Give the plants a thorough watering (the rose must be a fine one to do the work thoroughly). Spraying is, of course, the best system, and after having gone through the beds, water with the same material a narrow space round the beds, as the larvæ which have fallen to the ground will be on the lookout for a chance to escape, but will seldom attempt to cross the line of tar-impregnated surface of the soil, where they will soon die,

Before planting, the bundles of young plants should be submerged in a decoction of weak tobacco water, to which a little soap and tar water could, with advantage, be added. In this, they should remain for fully an hour, when they could be dipped in clean water and planted out into the positions in which they are to remain until required for market.

Our plants may now be supposed to have been set out where they are to remain, and an occasional spraying would be the best and, in the end, the cheapest. The cabbage aphis also cannot stand the smell of tar, so these two destructive pests can be fought at the same time and almost by the same method.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF FEBRUARY IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALLS DURING FEBRUARY, 1920 AND 1919, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Feb.	No. of Years' Records.	Feb., 1920.	Feb., 1919.
North Coast.	In.		In.	In.
Atherton	9·29	19	7·11	1·81
Cairns	14·83	38	18·73	7·85
Cardwell	16·87	48	9·60	8·88
Cooktown	13·53	44	14·62	10·29
Herberton	7·42	33	5·12	2·81
Ingham	15·44	28	11·97	6·05
Innisfail	19·64	39	13·81	11·32
Mossman	14·84	12	18·95	16·46
Townsville	11·98	49	4·00	8·36
Central Coast.				
Ayr	9·20	33	4·16	2·54
Bowen	8·80	49	0·77	3·73
Charters Towers ...	4·52	38	0·78	2·21
Mackay	11·61	49	3·54	6·05
Proserpine	10·75	17	3·07	4·94
St. Lawrence ...	8·11	49	2·15	1·55
South Coast.				
Biggenden	3·84	21	0·73	2·71
Bundaberg	6·34	37	0·32	3·22
Brisbane	6·40	69	1·04	0·89
Childers	6·19	25	0·55	3·77
Crohamhurst ...	14·33	27	3·85	3·10
Esk	5·66	33	0·79	0·53
Gayndah	4·23	49	0·25	1·93
Gympie	6·68	50	1·85	2·63
Glasshouse M'tains	8·90	12	2·56	2·71
Kilkivan	5·13	41	0·18	1·83
Maryborough ...	6·60	49	1·22	2·40

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Feb.	No. of Years' Records.	Feb., 1920.	Feb., 1919.
South Coast—continued:	In.		In.	In.
Nambour	8·66	24	5·05	5·06
Nanango	4·45	38	0·60	2·58
Rockhampton ...	7·70	33	1·55	3·31
Woodford	9·11	33	1·73	2·36
Darling Downs.				
Dalby	2·97	50	0·68	3·38
Emu Vale	2·36	24	0·55	1·54
Jimbour	2·98	32	0·73	2·13
Miles	2·72	35	1·15	1·29
Stanthorpe ...	3·38	47	1·57	2·58
Toowoomba ...	4·44	48	0·70	0·76
Warwick	3·01	33	0·80	2·24
Maranoa.				
Roma	3·11	46	4·08	3·33
State Farms, &c.				
Bungeworgorai ...	2·95	6	3·30	5·15
Gatton College ...	3·05	21	0·18	0·55
Gindie	2·88	21	0·73	1·57
Hermitage ...	2·52	14	0·80	2·97
Kairi	6·47	6	...	2·65
Sugar Experiment Station, Mackay	10·27	23	3·06	6·75
Warren	4·86	6	1·40	2·55

NOTE.—The averages have been compiled from official data during the periods indicated; but the totals for February this year, and for the same period of 1919, having been compiled from telegraphic reports, are subject to revision.

GEORGE G. BOND, State Meteorologist.

Botany.

RESULTS OF FEEDING EXPERIMENTS WITH A SUSPECTED POISONOUS PLANT.

(*WICKSTROEMIA INDICA*, C. A. MEY).

BY C. J. POUND AND C. T. WHITE.

DESCRIPTION.—A shrub with a reddish, very fibrous bark. Leaves about 2 inches long, tapering towards each end. Flowers greenish-yellow, small (about ¼ inch long), borne in little clusters at the ends of the branchlets. Fruit red, fleshy, oval or oblong, about ½ inch or more long.

Common Name.—It is commonly called "Tie Bush," a name, however, that is also applied to several plants of the closely allied genus *Pimelea*.

Suspected Poisonous Properties.—It is commonly sent in as a plant suspected of causing losses amongst stock, particularly in the "scrub" areas of South-eastern Queensland, and Bailey has several times* referred to its suspected poisonous properties. In the following feeding experiment, however, as the plant is one generally avoided by stock, the animals ate a great deal more than they would under ordinary conditions, and it appears to have had no other effect on them than to cause severe scouring. Had the feeding been continued, the animals would quite likely have died from scours and malnutrition, but stock would hardly ever eat sufficient of the plant for this to occur under natural conditions.

FEEDING EXPERIMENT WITH LEAVES OF "TIE BUSH" (*WICKSTROEMIA INDICA*), COMMENCED 6TH FEBRUARY, COMPLETED 18TH FEBRUARY, 1920.

BLACK JERSEY HEIFER. No. 421.

Date.	Experiment.	Result.
Feb. 7 ..	5 p.m.—Fed with ½ lb. leaves and 2 lb. chaff.	All eaten.
Feb. 8 ..	6.30 a.m.—Fed with ½ lb. leaves and 2 lb. chaff.	All eaten.
Feb. 8 ..	12 a.m.—Fed with ½ lb. leaves and 2 lb. chaff.	All eaten.
Feb. 8 ..	5 p.m.—Fed with ½ lb. leaves and 2 lb. chaff.	All eaten.
Feb. 9 ..	12 a.m.—Fed with ½ lb. leaves and 2 lb. chaff.	None eaten.
Feb. 9 ..	5 p.m.—Fed with ½ lb. leaves and 2 lb. chaff.	All eaten.
Feb. 10 ..	6.30 a.m.—Fed with ½ lb. leaves and 2 lb. chaff.	All eaten.
Feb. 10 ..	12 a.m.—Fed with 1 lb. leaves and 5 p.m. 2 lb. chaff.	All eaten.
Feb. 11 ..	6.30 a.m.—Fed with 1 lb. leaves and 2 lb. chaff.	A little eaten; scours.
Feb. 11 ..	12 a.m.—Fed with 1 lb. leaves and 5 p.m. 2 lb. chaff.	None eaten.
Feb. 12 ..	6.30 a.m.—Fed with 1 lb. leaves and 2 lb. chaff.	None eaten; scours, with traces of blood; temp. at 3.30 p.m., 102.4°.
Feb. 12 ..	12 a.m.—Fed with 1 lb. leaves and 2 lb. chaff.	Very little eaten.

* F. M. Bailey and P. R. Gordon, "Plants Reputed Poisonous to Stock," p. 75; F. M. Bailey, "Weeds and Suspected Poisonous Plants of Queensland," p. 172; and "Queensland Flora," p. 1369.

Plate 14.—Wickstroemia indica.
A. "Tie Bush." Flowers greenish-yellow. Berries red.

BLACK JERSEY HEIFER. No. 421.—*continued.*

DATE.	EXPERIMENT.	RESULT.
Feb. 12 ..	5 p.m.—Fed with 1 lb. leaves and 2 lb. chaff.	All eaten.
Feb. 13 ..	6.30 a.m.—Fed with 1½ lb. leaves and 2 lb. chaff.	Mostly all eaten; scours.
Feb. 13 ..	12 a.m.—Fed with 1½ lb. leaves and 2 lb. chaff.	Mostly all eaten; temp. 3.30 p.m., 102°.
Feb. 13 ..	5 p.m.—Fed with 1½ lb. leaves and 2 lb. chaff.	Very little eaten; scours.
Feb. 14 ..	6.30 a.m.—Fed with 1½ lb. leaves and 2 lb. chaff.	Very little eaten; scours.
Feb. 14 ..	12 a.m.—Fed with 1½ lb. leaves and 2 lb. chaff.	Very little eaten; scours.
Feb. 14 ..	5 p.m.—No Tie bush available. Fed with chaff.	Condition improved; scours.
Feb. 15 ..	— No Tie bush available. Fed with chaff.	Slightly better.
Feb. 16 ..	6.30 a.m.—No Tie bush available. Fed with chaff.	
Feb. 16 ..	12 a.m.—Fed with 1½ lb. leaves and 3 lb. chaff.	Mostly all eaten.
Feb. 16 ..	5 p.m.—Fed with 1½ lb. leaves and 3 lb. chaff.	Mostly all eaten.
Feb. 17 ..	6.30 a.m.—Fed with 1½ lb. leaves and 3 lb. chaff.	Mostly all eaten.
Feb. 17 ..	12 a.m.—Fed with 1½ lb. leaves and 3 lb. chaff.	Mostly all eaten.
Feb. 17 ..	5 p.m.—Fed with 1½ lb. leaves and 3 lb. chaff.	Condition same.

YOUNG YELLOW JERSEY HEIFER. No. 416.

Feb. 7 ..	5 p.m.—Fed with ½ lb. leaves and 2 lb. chaff.	All eaten.
Feb. 8 ..	6.30 a.m.—Fed with ½ lb. leaves and 2 lb. chaff.	All eaten.
Feb. 8 ..	12 a.m.—Fed with ½ lb. leaves and 2 lb. chaff.	All eaten.
Feb. 8 ..	5 p.m.—Fed with ½ lb. leaves and 2 lb. chaff.	All eaten.
Feb. 9 ..	12 a.m.—Fed with ½ lb. leaves and 2 lb. chaff.	Very little eaten.
Feb. 9 ..	5 p.m.—Fed with ½ lb. leaves and 2 lb. chaff.	All eaten.
Feb. 10 ..	6.30 a.m.—Fed with ½ lb. leaves and 2 lb. chaff.	Very little eaten.
Feb. 10 ..	12 a.m.—Fed with ½ lb. leaves and 2 lb. chaff.	All eaten.
Feb. 10 ..	5 p.m.—Fed with 1 lb. leaves and 2 lb. chaff.	All eaten.
Feb. 11 ..	6.30 a.m.—Fed with 1 lb. leaves and 2 lb. chaff.	All eaten.
Feb. 11 ..	12 a.m.—Fed with 1 lb. leaves and 2 lb. chaff.	All eaten.
Feb. 11 ..	5 p.m.—Fed with 1 lb. leaves and 2 lb. chaff.	All eaten.
Feb. 12 ..	6.30 a.m.—Fed with 1 lb. leaves and 2 lb. chaff.	All eaten.
Feb. 12 ..	12 a.m.—Fed with 1½ lb. leaves and 2 lb. chaff.	All eaten; scours, with traces of blood.
Feb. 12 ..	5 p.m.—Fed with 1½ lb. leaves and 2 lb. chaff.	All eaten; temp. at 3.30 p.m., 101.8°.
Feb. 13 ..	6.30 a.m.—Fed with 1½ lb. leaves and 2 lb. chaff.	All eaten; scours.

YOUNG YELLOW JERSEY HEIFER. No. 416.—*continued.*

Date.	Experiment.	Result.
Feb. 13 ..	12 a.m.—Fed with 2 lb. leaves and 2 lb. chaff.	All eaten; temp. at 3.30 p.m., 101.4°.
Feb. 13 ..	5 p.m.—Fed with 2 lb. leaves and 2 lb. chaff.	All eaten; scours and traces of blood.
Feb. 14 ..	6.30 a.m.—Fed with 2 lb. leaves and 2 lb. chaff.	All eaten; scours and traces of blood.
Feb. 14 ..	12 a.m.—Fed with 2 lb. leaves and 2 lb. chaff.	All eaten; scours and traces of blood.
Feb. 14 ..	5 p.m.—Fed with 2 lb. leaves and 2 lb. chaff.	All eaten; scours and traces of blood.
Feb. 15 ..	— No Tie bush available. Fed with chaff.	Condition slightly improved, and scours.
Feb. 16 ..	12 a.m.—Fed with 2 lb. leaves and 3 lb. chaff.	Slightly better.
Feb. 16 ..	5 p.m.—Fed with 2 lb. leaves and 3 lb. chaff.	All eaten; condition about same.
Feb. 17 ..	6.30 a.m.—Fed with 2 lb. leaves and 3 lb. chaff.	All eaten; condition about same.
Feb. 17 ..	12 a.m.—Fed with 2 lb. leaves and 3 lb. chaff.	All eaten; condition about same.
Feb. 17 ..	5 p.m.—Fed with 2 lb. leaves and 3 lb. chaff.	All eaten; condition about same.

Result.—Both animals very emaciated and badly scoured; no other symptoms.

BREAD FROM MAIZE AND SAUCE FROM CASSAVA.

Many years ago, when much of the flour required by farmers and others settled on the land in this State was imported from Chili and Adelaide, white maize was frequently used in conjunction with flour for bread-making. The maize was ground at Pettigrew's sawmills, and utilised for making porridge as well as for eking out the flour supplies.

Writing from Pomona (North Coast Line), a correspondent, under the pseudonym "Bush Bloke," says that, in view of the shortage of flour and abundance of maize, the following extract from Bell's "The Naturalist in Nicaragua" may prove of interest to many of our readers:—

"In Central America the bread made from maize is prepared at the present day exactly as was done in ancient Mexico. The grain is first boiled along with wood ashes or a little lime, the alkali having the effect of loosening the outer skin of the grain, which is then rubbed off in running water, a little at a time, placed upon a slightly concave stone called a 'melatl' (from the Aztec metlatl), on which it is rubbed with another stone, shaped like a rolling-pin. A little water is thrown on it as it is being bruised, and it is then formed into a paste. A ball of the paste is then taken and flattened out between the hands into a cake about 10 inches in diameter and three-sixteenths of an inch thick, which is baked on a slightly concave earthenware pan. The cakes so made are called 'tortillas,' and are very nutritious. When well made, and eaten warm, they are very palatable, and I preferred them to bread made from wheaten flour."

To those who have a patch of cassava, the following from Bates's "The Naturalist on the Amazons," may be of interest:—

"To these (fish), we used a sauce in the form of a yellow paste, quite new to me, called 'Arube,' which is made of the poisonous juice of the Mandioca (Cassava) root, boiled down before the starch or tapioca is precipitated, and seasoned with capsicum pepper. Several weeks before using, it is kept in stone bottles, and is a most appetising relish to fish."

General Notes.

LONDON MARKETS.

March 13.—Cotton, 25$\frac{3}{4}$d. per lb; rubber (Para) 2s. 5$\frac{1}{2}$d., plantation 2s. 6$\frac{1}{4}$d., smoked 2s. 6$\frac{5}{8}$d. per lb; copra, £67 per ton; sisal hemp, £60 per ton; linseed oil, £125 per ton.

PRICE OF PIGS.

At Toowoomba, on 19th March, 220 pigs were offered. Quotations were: Baconers, from £4 to £8, according to quality; porkers, £2 15s. to £4; stores, good, £2 10s. to £3 10s.; slips, 30s.; suckers, 15s. to 25s.

At Crow's Nest, on the same date, prices were as follows:—Baconers, £6 to £7 18s.; store pigs were keenly competed for, one vendor making £51 for 17 stores

NOTICE TO COTTON-GROWERS.

The attention of cotton-growers is drawn to the fact that some growers are consigning their cotton to this Department in one- or two-bag lots at frequent intervals, instead of waiting until a fairly reasonable load is forthcoming.

The time taken in carting from rail to store and the finding and clearing of same is often as great in the case of a single bag as, say, a dozen, and the cartage necessarily falls heavier on the small consignment.

This Department, in the interest of the cotton industry, includes cotton with other goods carted to this Office whenever possible in order to lessen the cost to the grower, but it sometimes happens that no other goods are offering and special trips have to be made.

It is also advisable to brand the bags before sending with your initials or stock brand and inform this Department by letter or postcard when it is being railed and how branded.

MULE WITH A FOAL.

In reply to a request from a Townsville inquirer for an instance of a mule having had a foal, the "Pastoral Review" of 16th February published the following, which appeared in an English paper a few years back:—

"A FERTILE MULE.

"Sir,—On 5th July I was called to examine a female mule with foal at foot. I was informed that it was her second, as last year she gave birth to a filly foal, which lived two months and died. The present one is a colt two months old, by a jack donkey, and somewhat resembles a young donkey, but bigger. The mule is six years old, 13.2$\frac{1}{2}$ high, and bay, with black points. No special marks or stripes, and a very good type of mule. I can only find out that she was bred from a she donkey, sire unknown. She is giving milk, and the foal suckled in my presence. The island is noted for its mules, and I certify that it is a genuine mule and foal.—G. J. Harvey, M.R.C.V.S., Government Veterinary Surgeon.

"Nicosia, Cyprus, 17th July."

DISEASE IN CAPSICUMS.

A sample plant of capsicums in which the fruit was nearly fully grown was brought to this office last week, and submitted to Mr. Hy. Tryon, Government Entomologist, for his opinion on a disease which had seriously affected all the pods, causing them to shrivel and finally die.

Mr. Tryon stated that he had a previous record of this fruit being one affected by the fruit-fly, but this contribution was of peculiar interest, as in most cases the injury resulted from punctures of some ovipositor, which had left its eggs in the pericarp, but in most cases, as in this, the fruit had already formed new tissue over that injured, in a manner similar to that which is found in the case of passion fruit.

THE TRAPPING SEASON.

A proclamation was gazetted on the 19th March, 1920, under the Native Animals Protection Acts, fixing the open season for opossums from 1st April to 30th June, 1920. No open season will be proclaimed for native bears, and these animals will remain totally protected. With regard to the use of cyanide of potassium, this has become so serious that further stringent regulations are about to be issued, especially regarding the sale of this poison, and holders of cyanide of potassium are warned that it will be inadvisable to sell this or any poison to persons reasonably suspected of requiring it for the purpose of killing native animals.

Answers to Correspondents.

DESTRUCTION OF WHITE ANTS.

In reply to a correspondent asking for a remedy against white ants attacking posts, Mr. J. C. Brünnich, Agricultural Chemist, advises:—"If the posts are not hollow, it is sufficient to clear away the soil from the posts to the depth of about 12 inches, and liberally sprinkle soil near the post with ordinary arsenic and fill up the hole again. If the posts are hollow, the posts will have to be bored to reach the hollow core and the arsenic can be put in by mixing it with water, or by making a solution by boiling the arsenic with an equal amount of washing soda. As a rule, solution is not required and the dry arsenic is found quite effective. At any place where the earth-covered tunnels in which the white ants work can be broken and a pinch of arsenic introduced, all the ants will be destroyed in a short time."

PREPARING CANDIED LEMON OR CITRON PEEL.

The fruit, when bright yellow, is picked and placed in barrels full of brine, and left for at least a month. The brine is renewed several times. The fruits are then taken from the barrels and boiled in fresh water to soften them. They are then cut in pieces, the seed is removed, and the fruit is again immersed in cold water, soon becoming of a greenish colour. After this it is placed in large earthen jars, covered with hot syrup, and allowed to stand about three weeks. During this time the strength of the syrup is gradually increased. The fruit is then put into boilers with crystallised sugar dissolved in a little water, and cooked, then allowed to cool, and boiled again until it will take up no more sugar. It is then dried and packed in wooden boxes.

CURING LEMONS.

REGINALD POOLE, Saltern Creek.—

A start should be made by picking a portion of the crop before it becomes too ripe—during the months of May, June, and July—and store such fruit away in a well-ventilated, dry, and cool building either in boxes or trays. It has been demonstrated that lemons keep best when pulled just as they are beginning to turn ripe. They are best picked when 2½ in. in diameter, even although almost green. They should be allowed to stand for a few days, and then packed away in paper-lined boxes or tins, or on trays, care being taken that none are bruised, for a bruised lemon is a spoilt lemon. The trays or boxes may be stacked in blocks in such a manner as to permit of a free circulation of air round each case. This is most important, as it allows any superfluous moisture to escape. The trays or boxes should be occasionally examined to remove any decaying fruit, say about every month or six weeks. In this way the fruit will keep for several months. The object in curing lemons is to reduce the thickness of the peel, and make it tough like a piece of kid glove, and to increase the juiciness. The colour will be intensified by this simple process.

COPRA-MAKING ON THE FARM. VINEGAR FROM MOLASSES.

"FARM," Gordonvale.—

In reply to your question concerning the making of copra on the farm on a small scale, this can easily be done as follows:—

Dry the kernels by means of the sun, having extracted the meat from the cracked nuts. Fire-dried copra is only fit for soap and candle making. The nuts must, of course, be ripe. Six thousand nuts will make 1 ton of copra, or, roughly, about three nuts to the pound. The kernels must be perfectly dried, otherwise a mould will set in—5 per cent. of moisture is all that can be allowed if mould is to be prevented.

After being halved, the nuts are placed in the sun, concave side up. The meat as it dries separates from the shell; the milk, of course, goes to waste on the soil. The operation takes about five days, unless rain should come on, when the kernels must be covered up at once or mould may set in.

In May, 1913, the cost of making copra in Queensland was about £18 per ton, one-third being the cost of upkeep of estates; one-third the cost of picking the nuts, transport to factory, husking, splitting, and removing the meat, drying the copra, bags, and bagging; the last third goes for transport to ship and freight. Were it not for labour troubles, the making, &c., of copra in Queensland should not exceed £15 per ton.

There are three methods employed in preparing copra. The most primitive in use in Papua and other islands, is by drying the kernels in the sun, either on the ground, on barbecues, or on drying racks and hurdles with provision for roofing in wet weather; secondly, on split bamboo hurdles, or on grills over fires; and thirdly, the artificial way of drying the kernels by means of hot air in ovens, or in buildings or rooms specially designed for the purpose.

VINEGAR FROM MOLASSES.

To 8 gallons of clear water, add 3 quarts of molasses; turn the mixture into a clean, light cask, shake it well two or three times, and add 3 spoonfuls of good yeast or two yeast cakes, place the cask in a warm spot, and in ten or fifteen days add a sheet of common wrapping paper, smeared with molasses and torn into narrow strips, and you will have good vinegar. The paper is necessary to form the "mother" or life of the vinegar.

You are quite right in what you say of clearing and rainfall. (See the "Queensland Agricultural Journal" for December, 1919, page 300.)

COTTON PICKING.

J. HOWARD, Woongarra, Bundaberg—

1. The greatest weight of cotton per bush in North Queensland (north of the Tropic of Capricorn) was gathered by Archdeacon Campbell on his cotton garden at Cairns. Weight, 21 lb.

2. A farmer on the Logan (south of the Tropic) claims to have gathered 20 lb. from a single bush.

At Capella, 170 miles inland from Rockhampton, just south of the Tropic, a farmer picked his whole crop at the rate of 28 lb. per hour.

In the United States white men have picked on an average 200 lb., and up to 400 lb. per day.

The best record for Queensland was 150 lb. per day, under ordinary conditions, per picker.

We shall be glad to receive the promised information regarding cotton culture.

Commenting on the practicability of utilising the method suggested of gathering the green pods from the field by mechanical means, Mr. Daniel Jones makes the following remarks:—

"The practice of utilising the green bolls in American plantations is one that has been in vogue for many years. It, however, has always been related to the harvesting of frosted bolls and the process is called 'Bollie picking.' Often the early frost in the plantations cuts the plant down, if an early one, thus doing damage to the unripened bolls. In order to minimise losses these 'bollies' are gathered by hand and paid for at the rate of 2s. 6d. per hundred pounds. They are then allowed to dry, and by means of machines called 'Bollie busters,' the fibre is removed and placed in a cotton gin and turned out in the ordinary way. In instances, the 'bollie' crop is large, particularly when a good season has forced an extra growth of cotton which has matured late and the frost has caught it ere the bolls have broken open.

"This danger in Queensland is not so imminent as in colder countries; the most that can happen in our coastal areas is that some of the immature pods may shrubs. I have often ripened bolls in the manner indicated with success and advantage when wanting specimens of seed or fibre on emergent occasions.

"As regards gathering the whole crop, as the article under review suggests, it may be of some value when raising the Upland types of cotton which are dwarfed and different in habit and character compared with our more robust perennial shrubs. I have often ripened bolls in the manner indicated with success and advantage when wanting specimens of seed or fibre on emergent occasions.

"To apply this system to our larger growing plants would be surrounded with difficulty, and would diminish the higher quality of the fibre by such rough treatment. No doubt some such method of dealing with Upland sorts, particularly in frosted districts, would enable growers to save some of their crop which otherwise would be lost."

The Markets.

PRICES OF FARM PRODUCE IN THE BRISBANE MARKETS FOR MARCH, 1920.

Article.		MARCH. Prices.
Arrowroot	ton	£60
Bacon	lb.	1s. 5d.
Barley	bush.	7s.
Bran	ton	£13
Broom Millet	,,	£40 to £60
Broom Millet (Sydney)	,,	£60 to £70
Butter (First Grade)	cwt.	200s. 8d.
Chaff, Lucerne	ton	£9 10s. to £17
Chaff, Mixed	,,	...
Chaff, Oaten	,,	£11
Chaff, Wheaten	,,	£13
Cheese	lb.	1s.
Flour	ton	£19 10s.
Hams	lb.	1s. 8d. to 1s. 10½d.
Hay, Lucerne	ton	£13 10s.
Hay, Oaten	,,	...
Honey	lb.	5d. to 7d.
Maize	bush	8s. 6d. to 11s. 6½d.
Oats	,,	7s. 3d.
Onions	ton	£10 to £22
Peanuts	lb.	7d. to 10d.
Pollard	ton	£10
Potatoes	,,	£10 3s. to £14 10s.
Potatoes (Sweet)	,,	£13
Pumpkins (Cattle)	,,	£8 to £10
Eggs	doz.	2s. 7d. to 3s. 3d.
Fowls	per pair	8s. to 8s. 6d.
Ducks, English	,,	5s. to 6s.
Ducks, Muscovy	,,	5s. to 8s.
Geese	,,	10s. to 12s.
Turkeys (Hens)	,,	10s. to 15s.
Turkeys (Gobblers)	,,	20s. to 45s.
Wheat	bush.	8s. 3d.

VEGETABLES—TURBOT STREET MARKETS.

Beans, per sugar-bag	3s. to 12s.
Beetroot, per dozen bunches	9d. to 1s.
Cabbages, per dozen	3s. 6d to 18s.
Carrots, per dozen bunches	1s. 9d. to 2s. 6d.
Chocos, per quarter-case	2s. to 3s.
Cucumbers, per dozen	3d. to 1s. 9d.
Lettuce, per dozen	9d. to 1s. 6d
Marrows, per dozen	2s. 6d. to 7s. 6d.
Parsnips, per dozen bunches	1s. to 2s.
Peas, per sugar-bag	8s. to 18s.
Potatoes (Sweet), per sugar-bag	6s. to 8s.
Pumpkins (table), per sack	2s. 6d. to 11s. 6d
Tomatoes, per quarter-case	2s. 6d. to 7s. 6d.
Turnips (Swede), per sugar-bag	1s. 6d. to 2s. 3d.

SOUTHERN FRUIT MARKETS.

Article.	MARCH. Prices.
Bananas (Tweed River), per double-case	12s. to 21s. 6d.
Lemons, per bushel-case	14s.
Pineapples (Queens), per double-case	8s. to 14s.
Pineapples (Ripleys), per double-case	7s. to 12s.
Pineapples (Common), per double-case	7s. to 9s.
Oranges (Navel), per case	18s. to 20s.
Oranges (Other, Choice), per case	18s. to 20s.
Oranges (Second Crop), per case	4s. to 8s.
Tomatoes, per case	5s. to 9s.

PRICES OF FRUIT—TURBOT STREET MARKETS.

Apples, Eating, per bushel-case	5s. to 10s.
Apples, Cooking, per bushel-case	4s. to 9s.
Apricots, per quarter-case (Prime)	...
Apricots, per quarter-case (Small)	...
Bananas (Cavendish), per dozen	2d. to 8d.
Bananas (Sugar), per dozen	2d. to 6d.
Citrons, per cwt.	10s. to 14s.
Cocoanuts, per sack	£1 5s.
Grapes, per lb.	3d. to 8d.
Lemons (Lisbon), per half bushel-case	5s. 6d. to 7s. 6d.
Lemons (Rough), per cwt.	...
Mandarins, per case	13s. to 18s.
Limes, per half bushel-case	...
Mangoes, per bushel-case	2s. to 14s.
Nectarines, per quarter-case	...
Oranges (second crop), per quarter-case	3s. to 5s.
Oranges (inferior), per quarter-case	...
Papaw Apples, per quarter-case	1s. 6d. to 12s.
Passion Fruit, per quarter-case	2s. to 10s.
Peaches, per quarter-case	2s. to 8s. 6d.
Pears	8s. to 12s.
Persimmons, per quarter-case	2s. to 5s.
Pineapples (Rough), per dozen	3s. 6d. to 8s.
Pineapples (Smooth), per dozen	3s. 6d. to 8s.
Pineapples (Ripley), per case	3s. to 7s.
Plums, per quarter-case	8s. to 14s. 6d.
Rock melons, per dozen	...
Tomatoes (prime), per quarter-case	2s. 6d. to 7s. 6d.
Tomatoes (inferior), per quarter-case	2s. to 3s.
Water melons, per dozen	2s. to 5s.

TOP PRICES, ENOGGERA YARDS, FEBRUARY, 1920.

Animal.	FEBRUARY. Prices.
Bullocks	£26 10s. to £40 15s.
Cows	£17 to £22 2s. 6d.
Merino Wethers	46s. 3d.
Crossbred Wethers	65s.
Merino Ewes	45s.
Crossbred Ewes	60s.
Lambs	58s.

Farm and Garden Notes for May.

FIELD.—During this month, the principal work in the field will be the sowing of wheat, barley, oats, rye, and vetches. There is no time to lose now at this work. Potatoes should be hilled up. Cut tobacco. The last of the cotton crop should now be picked, the bushes being stripped daily after the dew has evaporated. Cotton-growers are notified that cotton-ginning and baling machinery has been installed on the premises of the Department of Agriculture and Stock in William street, where seed cotton will be received by the department from the growers, to whom an advance of not less than 4d. per lb. will be paid. The cotton will then be ginned, baled, and marketed in the best market, and whatever balance to credit is shown when account sales are received will be distributed amongst the suppliers according to the amount of cotton supplied by them. Only bare expenses of preparing the shipments and freight, if the cotton is exported, will be deducted. Thus it will be seen that cotton-growers will have a sure market for their produce. Every effort should be made to ensure feed for stock during the winter by utilising all kinds of green fodder in the form of silage or hay. Those who own dairy stock will be wise to lay down permanent grasses suitable to their particular district and soil. A few acres of artificial grass, notably Rhodes grass, will support a surprisingly large number of cattle or sheep in proportion to acreage. Couch grass in the West will carry ten to twelve sheep to the acre. Coffee-picking should now be in full swing, and the berries should be pulped as they are picked. Strawberries may be transplanted. The best varieties are Pink's Prolific, Aurie, Marguerite, Annetta, Phenomenal, Hautbois, and Trollope's Victoria. Aurie and Marguerite are the earliest. In some localities, strawberry planting is finished in March, and the plants bear their first fruits in August. In others, fruit may be gathered in July, and the picking does not end until January.

KITCHEN GARDEN.—Onions which have been planted in seed beds may now be transplanted. The ground should long since have been thoroughly cleaned, pulverised, and should be rolled previous to transplanting. Onions may still be sown in the open on clean ground. In favourable weather plant out cabbages, cauliflowers, lettuce, leeks, beetroot, endive, &c. Sowings may also be made of all these as well as of peas, broad beans, khol-rabi, radishes, spinach, turnips, parsnips, and carrots. Dig and prepare beds for asparagus.

FLOWER GARDEN.—Planting and transplanting may be carried out simultaneously during this month in showery weather; the plants will thus be fully established before the early frosts set in. Camellias and gardenias may be safely transplanted also such soft-wooded plants as verbenas, petunias, pentstemons, heliotrope, &c. Cut back and prune all trees and shrubs ready for digging. Dahlia roots should be taken up and placed in a shady situation out of doors. Plant bulbs such as anemones, ranunculus, snowflakes, fresias, ixias, watsonias, iris, narcissus, daffodils, &c. Tulips will not suit the Queensland climate, but hyacinths may be tried, although success is doubtful. All shades and screens may now be removed to enable plants to get the full benefit of the air. Fork in the mulching, and keep the walks free from weeds. Clip hedges and edgings.

Orchard Notes for May.

THE SOUTHERN COAST DISTRICTS.

The advice given respecting the handling and marketing of citrus fruits in the last two numbers of this Journal applies with equal force to this and the following months. Do not think that you can give the fruit too much care and attention; it is not possible, as the better they are handled, graded, and packed, the better they will carry, and the better the price they will realise.

Continue to pay careful attention to specking, and fight the blue mould fungus everywhere. Don't let mouldy fruit lie about on the ground, hang on the trees, or be left in the packing-shed, but destroy it by burning. Keep a careful lookout for fruit fly, and sweat the fruit carefully before packing. If this be done, there will be little fear of the fruit going bad in transit or being condemned on its arrival at Southern markets. Where the orchard has not been already cleaned up, do so now, and get it in good order for winter. Surface working is all that is required, just sufficient to keep moisture in the soil; keep down undergrowths, and prevent the packing of the surface soil by trampling it down when gathering the fruit.

Keeping the orchard clean in this manner enables any fallen fruit to be easily seen and gathered, and it need hardly be stated, what has been mentioned many times before, that diseased fruit should on no account be allowed to lie about and rot on the ground, as this is one of the most frequent causes of the spreading of many fruit pests.

May is a good month to plant citrus trees, as if the ground is in good order they get established before the winter, and are ready to make a vigorous growth in spring.

Don't plant the trees, however, till the land is ready, as nothing is gained thereby, but very frequently the trees are seriously injured, as they only make a poor start, become stunted in their growth, and are soon overtaken by trees planted later, that are set out under more favourable conditions. The land must be thoroughly sweet, and in a good state of tilth—that is to say, deeply worked, and worked down fine. If this has been done, it will probably be moist enough for planting; but should there have been a dry spell, then, when the hole has been dug and the trees set therein, and the roots just covered with fine top soil, 4 to 8 gallons of water should be given to each tree, allowed to soak in, and then covered with dry soil to fill up the hole. In sound, free, sandy loams that are naturally scrub soils, holes may be dug and the trees planted before the whole of the ground is brought into a state of perfect tilth. It is, however, better to do the work prior to planting, as it can then be done in the most thorough manner; but if this is not found possible, then the sooner it is done after planting, the better. If the land has been thoroughly prepared, there is no necessity to dig big holes, and in no case should the holes be dug deeper than the surrounding ground either is or is to be worked. The hole need only be big enough to allow the roots to be well spread out, and deep enough to set the tree at the same depth at which it stood when in the nursery. Plant worked trees 24 to 25 ft. apart each way, and seedlings at least 30 ft. apart each way.

Towards the end of the month cover pineapples when there is any danger of frost; dry blady grass or bush hay is the best covering. Keep the pines clean and well worked—first, to retain moisture—and, secondly, to prevent injury from frost—as a patch of weedy pines will get badly frosted when a clean patch alongside will escape without any serious injury.

Slowly acting manures—such as meatworks manure when coarse, boiling-down refuse, farm manure, or composts—may be applied during the month, as they will become slowly available for the trees' use when the spring growth takes place; but quickly acting manures should not be applied now.

THE TROPICAL COAST DISTRICTS.

May is a somewhat slack month for fruit—pines, papaws, and granadillas are not in full fruit, the autumn crop of citrus fruit is over, and the spring crop only half-grown. Watch the young citrus fruit for Maori, and when it makes its appearance spray with the sulphide of soda wash. Keep the orchard clean, as from now till the early summer there will not be much rain, and if the orchard is allowed to run wild—viz., unworked and dirty—it is very apt to dry out, and both the trees and fruit will suffer in consequence.

Bananas should be kept well worked for this reason, and though the fly should be slackening off, every care must still be taken to prevent any infested fruit being sent to the Southern markets.

Citrus fruits can be planted during the month, the remarks *re* this under the heading of the Southern Coast Districts being equally applicable here.

THE SOUTHERN AND CENTRAL TABLELANDS.

Get land ready for the planting of new deciduous orchards, as although there is no necessity to plant so early, it is always well to have the land in order, so as to be ready to plant at any time that the weather is suitable. The pruning of deciduous trees can commence towards the end of the month in the Stanthorpe district, and be continued during June and July. It is too early for pruning elsewhere, and too early for grapes, as a general rule. Keep the orchard clean, particularly in the drier parts. In the Stanthorpe district the growing of a crop of blue or grey field peas, or a crop of vetches between the trees in the older orchards, is recommended as a green manure. The crop to be grown as a green manure should have the soil well prepared before planting, and should be manured with not less than 4 cwt. of phosphatic manure, such as Thomas's phosphate, or fine bonedust, per acre. The crop to be ploughed in when in the flowering stage. The granitic soils are naturally deficient in organic matter and nitrogen, as well as phosphoric acid, and this ploughing in of a green crop that has been manured with a phosphatic manure will have a marked effect on the soil.

Lemons will be ready for gathering in the Roma, Barcaldine, and other districts. They should be cut from the trees, sweated, and cured down, when they will keep for months, and be equal in quality to the imported Italian or Californian fruit. If allowed to remain on the trees, the fruit becomes over-large and coarse, and is only of value for peel. Only the finest fruit should be cured; the larger fruit, where the skin in thicker, is even better for peel, especially if the skin is bright and free from blemish; scaly fruit, scabby, warty, or otherwise unsightly fruit is not suitable for peel, and trees producing such require cleaning or working over with a better variety, possibly both.

The remarks *re* other citrus fruit and the work of the orchard generally, made when dealing with the coast districts, apply equally well here, especially as regards handling the crop and keeping down pests.

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S.

TIMES OF SUNRISE AND SUNSET.

AT BRISBANE.

1920.	JANUARY.		FEBRUARY.		MARCH.		APRIL.	
Date.	Rises.	Sets.	Rises.	Sets.	Rises.	Sets.	Rises.	Sets.
1	4·57	6·45	5·21	6 42	5·42	6·19	5·59	5 46
2	4·58	6·46	5·22	6·42	5·42	6·18	5·59	5·44
3	4·59	6·46	5·23	6·41	5·43	6·17	6·0	5·43
4	5·0	6·46	5·24	6·41	5·44	6·16	6·0	5·42
5	5·0	6·46	5·24	6·40	5·44	6·15	6·1	5·41
6	5·1	6·47	5·25	6·39	5·45	6·14	6·1	5·40
7	5·2	6·47	5·26	6·39	5·45	6·13	6 2	5 39
8	5·2	6·47	5·27	6·38	5·46	6·12	6·2	5·38
9	5·3	6·47	5·28	6·37	5·46	6·11	6 3	5 37
10	5·3	6·47	5·28	6·36	5·47	6·10	6·3	5·36
11	5·4	6·47	5·29	6·36	5·48	6·9	6·4	5·35
12	5·5	6·47	5·30	6 35	5·48	6·8	6·4	5 35
13	5·6	6·47	5·31	6·35	5·49	6·7	6 4	5·34
14	5·6	6·47	5·31	6 34	5·49	6·6	6·5	5·33
15	5·7	6·47	5 32	6·33	5·50	6·5	6 5	5 32
16	5·8	6·47	5 33	6·32	5·50	6·4	6·6	5 31
17	5·9	6·47	5·33	6·31	5 51	6·3	6·6	5·30
18	5·10	6·47	5·34	6·30	5·51	6 2	6·7	5·29
19	5·10	6·47	5 35	6·29	5 52	6·1	6 7	5·28
20	5·11	6·47	5·35	6·28	5·52	6 0	6·8	5·27
21	5·12	6·46	5·36	6 28	5·53	5·59	6 8	5 26
22	5·13	6·46	5·36	6·27	5·53	5·58	6·9	5·25
23	5·14	6·46	5·37	6·26	5 54	5·57	6 9	5 24
24	5·15	6·45	5·38	6·25	5·54	5 56	6 10	5·23
25	5·16	6·45	5·38	6·24	5·55	5·55	6·10	5·22
26	5·16	6·45	5·39	6·23	5·56	5·53	6·11	5·21
27	5·17	6 44	5·40	6 22	5 56	5·52	6 11	5 20
28	5·18	6·44	5·41	6 21	5 57	5·50	6·12	5·19
29	5·19	6·43	5·41	6·20	5·57	5·49	6 12	5·18
30	5·20	6·43	...	...	5·58	5·48	6·13	5·18
31	5·21	6·42	...	...	5 58	5·47	...	...

PHASES OF THE MOON.

The times stated are for Queensland, New South Wales, and Victoria, where the clock time is identical.

			H. M.
6 Jan.	○	Full Moon	7 5 a.m.
13 ,,	☽	Last Quarter	10 9 a.m.
21 ,,	●	New Moon	3 27 p.m.
29 ,,	☾	First Quarter	1 38 a.m.

Perigee on 5th, Apogee on 17th. (An occultation of the planet Venus by the Moon will take place on the 17th. Unfortunately not visible in Australia.)

4 Feb.	○	Full Moon	6 42 p.m.
12 ,,	☽	Last Quarter	6 49 a.m.
20 ,,	●	New Moon	7 35 a.m.
27 ,,	☾	First Quarter	9 50 a.m.

Perigee on 2nd and 28th, Apogee on 13th

5 Mar.	○	Full Moon	7 13 a.m.
13 ,,	☽	Last Quarter	3 57 a.m.
20 ,,	●	New Moon	8 56 p.m.
27 ,,	☾	First Quarter	4 45 p.m.

Apogee on 12th, Perigee on 24th.

3 Apr.	○	Full Moon	8 55 p.m.
11 ,,	☽	Last Quarter	11 24 p.m.
19 ,,	●	New Moon	7 43 a.m.
25 ,,	☾	First Quarter	11 28 p.m.

Apog e on 9th, Perigee on 21st.

There will be no eclipse of the Sun or Moon till May 3rd.

For places west of Brisbane, but nearly on the same parallel of latitude—27½ degrees S.—add 4 minutes for each degree of longitude. For example, at Toowoomba the sun would rise about 4 minutes later than at Brisbane if it were not for its higher elevation, and at Oontoo (longitude 141 degrees E.) about 48 minutes later.

At St. George, Cunnamulla, and Thargomindah the times of sunrise and sunset will be about 18 m., 30 m., and 38 minutes respectively, later than at Brisbane.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhere about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.